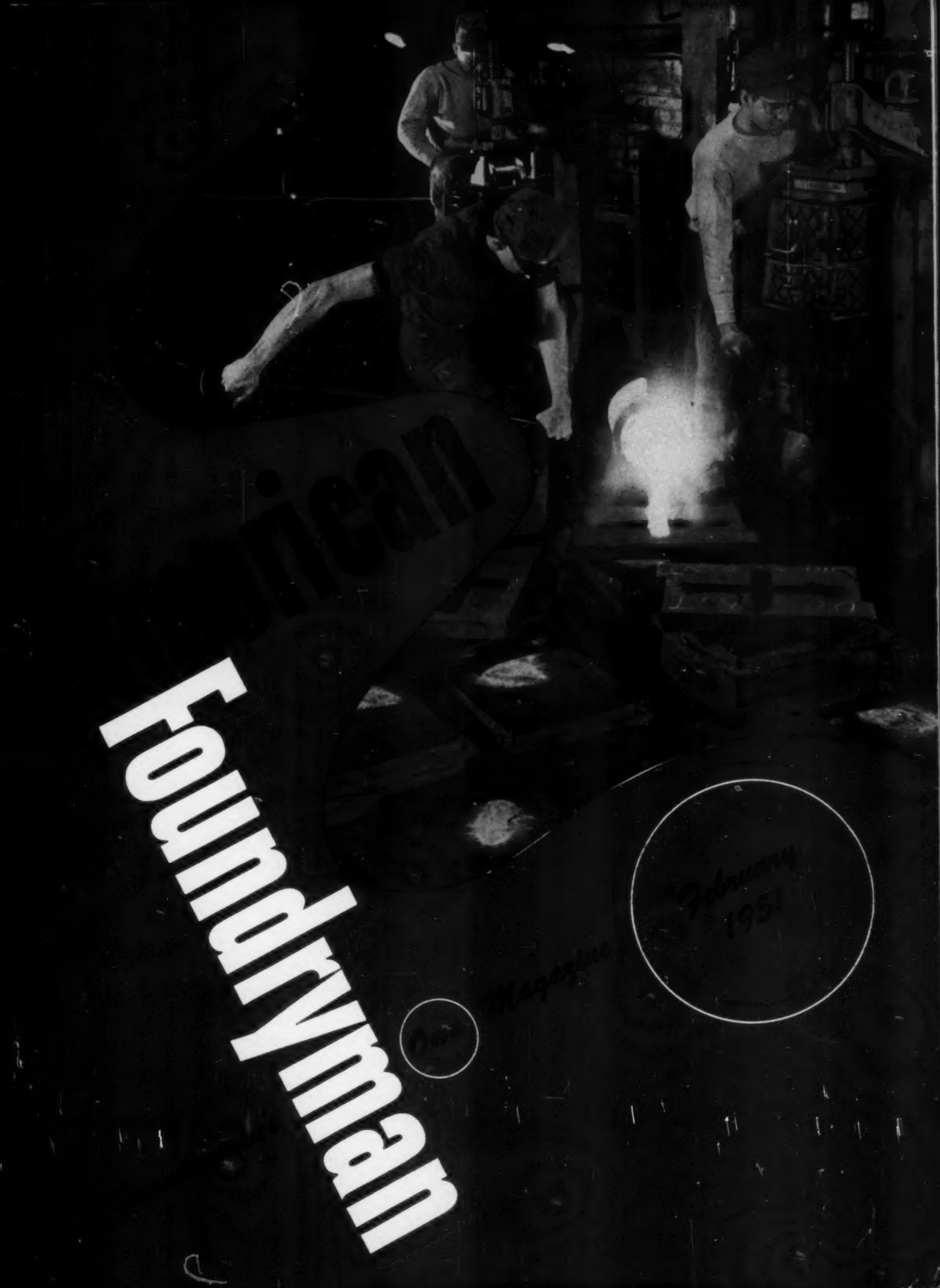
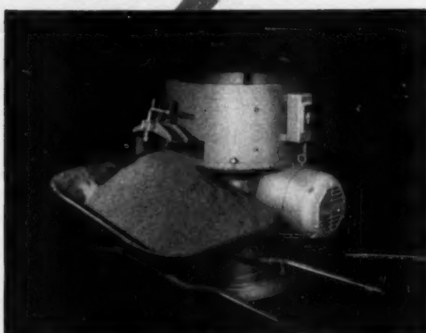

Foundryman
Magazine
February
1951

WHIRLMIX

Note 2 flexible steel rubbing arms.



Discharge door is 28" off floor, high enough to accomodate a 3 cu. ft. wheelbarrow.

Batch size 3 cu. ft.

NEW SAND MIXER

SMALL IN SIZE-BIG IN PRODUCTION

● The Whirlmix, a big producer, will mix more sand per hour at lowest cost . . . 4,000 lbs. of oil core sand or facing sand per hour.

Small—compact, the Whirlmix is an integral unit which does not require a foundation. Weighs only 1,060 lbs. Can be moved easily by crane or lift truck from one location to another.

Two flexible spring steel whirling arms exert the proper pressure to the sand. No crushing of sand grains; no overheating of sand. This produces a uniform mixture of either core oil, dry core compound, or facing sand. The Whirlmix gives you a fluffy sand (does not need aerating), efficiently mixed without crushing.

If you want a mixer which will give you tonnage, an efficient mix, and complete satisfaction, write us today about this new sand mixer . . . Whirlmix (Model No. 300) . . . small in size, a little giant in production . . . PROMPT DELIVERY.

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ABC

CONTENTS

VOLUME XIX, NUMBER 2

February, 1951

American Foundryman

Official publication of American Foundrymen's Society

Significance of adequate apprentice training becomes more apparent as castings requirements soar and international tension increases. From the ranks of apprentices such as these have come many of the men who supervise the production of the tremendous tonnages of castings now in demand.

Published monthly by the American Foundrymen's Society, Inc., 616 S. Michigan Ave., Chicago 5. Subscription price in the U. S., Canada and Mexico, $3.00 per year; elsewhere, $6.00. Single copies, 50c. Entered as second class matter July 22, 1938, under Act of March 3, 1879, at the Post Office, Chicago, Illinois. EASTERN REPRESENTATIVE—C. A. Larson & Associates, 254 West 31st St., New York 1, N. Y. CENTRAL REPRESENTATIVE—Enright & Cleary, 1836 Euclid Ave., Cleveland. MIDWESTERN REPRESENTATIVE—H. Thorpe Covington Co., 677 N. Michigan Ave., Chicago.

ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Division, Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

SILICON . . . Deoxidizes, Increases Strength, and Improves Electrical Properties of Metals

Silicon is one of the most important elements used in the iron, steel, and non-ferrous industries. It is an efficient low-cost deoxidizer; and in larger amounts, it is also an effective alloying element.

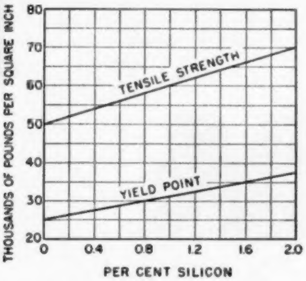
Efficient Deoxidizer

Silicon is used in practically all grades of carbon and alloy steels and offers an economical means of effectively eliminating oxides from the molten bath in all steel-making processes. Amounts up to about 0.80 per cent silicon are used for deoxidizing various steels used for forgings, wrought products, and castings.

Recent published research papers, covering work done in ELECTROMET's laboratories, have added greatly to the knowledge about the deoxidizing power of silicon by itself, and also in conjunction with other elements. Complete information is given in a report entitled "Solubility of Oxygen in Liquid Iron Containing Silicon and Manganese." If you would like a copy of this report, free of charge, write to the address above.

Improves Physical Properties

When used as an alloying element, silicon in small percentages will increase the tensile strength, yield point, and ductility of structural steels, such as those used for highly stressed parts of bridges. Some spring steels contain about 2 per cent silicon. Another application of silicon as an alloying element is in stainless steels, where it appreciably increases the resistance of these steels to certain types of corrosion and to high-temperature oxidation.



Effect of silicon on tensile strength and yield point of a steel containing approximately 0.10 per cent carbon.

Decreases Watt Loss

Silicon increases the magnetic permeability of steel. Hence silicon steel is specially suited for use as a "core" material in electrical generators, motors, transformers, electromagnets, and other electrical equipment. Because silicon decreases magnetic resistance, silicon steels show much lower hysteresis losses. As a result, energy or watt losses are greatly decreased and tremendous overall savings are effected in the generation, transmission, and use of electrical power. Up to 5 per cent silicon is used in sheet steel for electrical apparatus.

Benefits Cast Iron

In cast iron, silicon not only serves as a deoxidizer but also has a marked graphitizing effect. Silicon tends to soften cast iron, thereby improving machinability and providing a control over depth of chill and physical properties. In larger amounts, sometimes as much as 14 per cent, silicon makes cast iron suitable for handling highly corrosive acids in chemical plants.

Improves Non-Ferrous Alloys

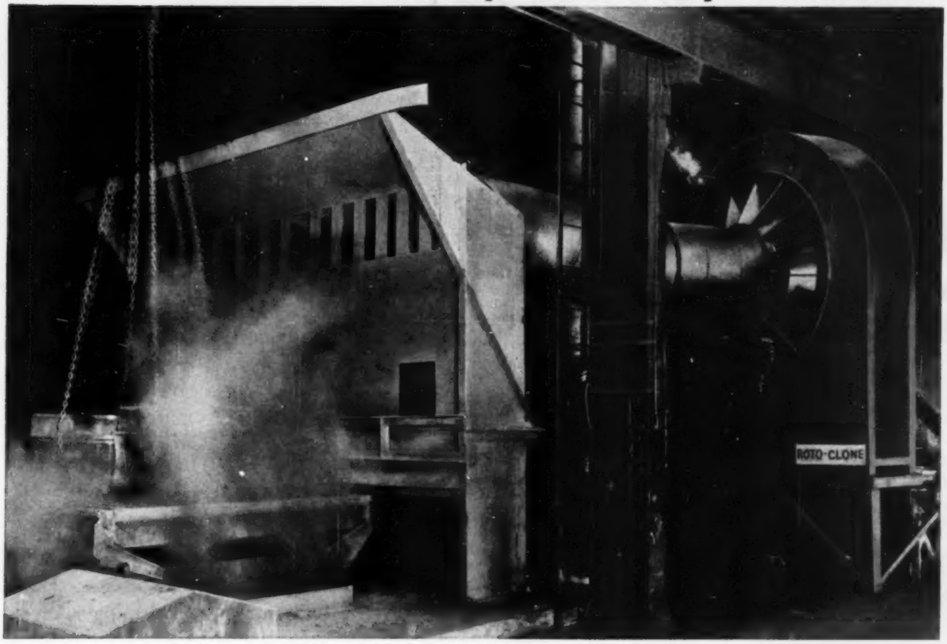
Silicon is used in non-ferrous alloys to increase strength and hardness, and to improve other physical properties. In various aluminum alloys, as much as 18 per cent silicon may be used. Copper alloys, too, frequently contain silicon: for example, the silicon bronzes.

ELECTROMET Alloys

Silicon is produced by ELECTROMET in the forms listed below, which are suitable for every use of the iron, steel, and non-ferrous metal industry. For a complete description of these alloys, write to the address above for a copy of the 100-page booklet, "ELECTROMET Ferro-Alloys and Metals." This booklet describes over 50 metals and alloys produced by ELECTROMET and tells of the unique technical service offered to the metal industries.

Alloys of Silicon and Their Uses

15% Ferrosilicon	In ground form, this alloy is used in the "sink and float" process of concentrating ores.
50% Ferrosilicon	Widely used as a deoxidizer; as a furnace block; and for adding silicon to fill specifications in the production of steel. Also used in the production of cast iron.
65% Ferrosilicon	Used mainly in the production of electrical sheet steel. (Available in low-aluminum grade only.)
75% Ferrosilicon	Used both as a deoxidizer and for alloying purposes in the production of steel, particularly steel containing high percentages of silicon. Also used for ladle additions to cast iron.
85% Ferrosilicon	Used for same general purposes as 75% ferrosilicon. Permits large silicon additions without harmful chilling effects.
90% Ferrosilicon	Used for same general purposes as 75% and 85% ferrosilicon. Permits large silicon additions without harmful chilling effects.
Silicon Metal	For use in the non-ferrous industry, particularly in the manufacture of aluminum and copper alloys. Also used to produce the organo-silicon compounds known as silicones.
Purified Silicon Metal	For special applications requiring silicon metal of the greatest purity.
"SMZ" Alloy	For ladle additions in the production of cast iron. Exerts strong graphitizing effect.
"ELECTROMET" Special Graphitizer	For ladle additions in the production of cast iron.
"EM" Silicon Briquets	For adding silicon to cast iron in the cupola or air furnace.
Silicomanganese	For adding silicon and manganese simultaneously in steel making processes.


ROTO-CLONE

Stevens Liquid Parting being applied by spray to a matchplate at Wagner Malleable Iron Company's foundry.

ANOTHER SATISFIED *Stevens* CUSTOMER

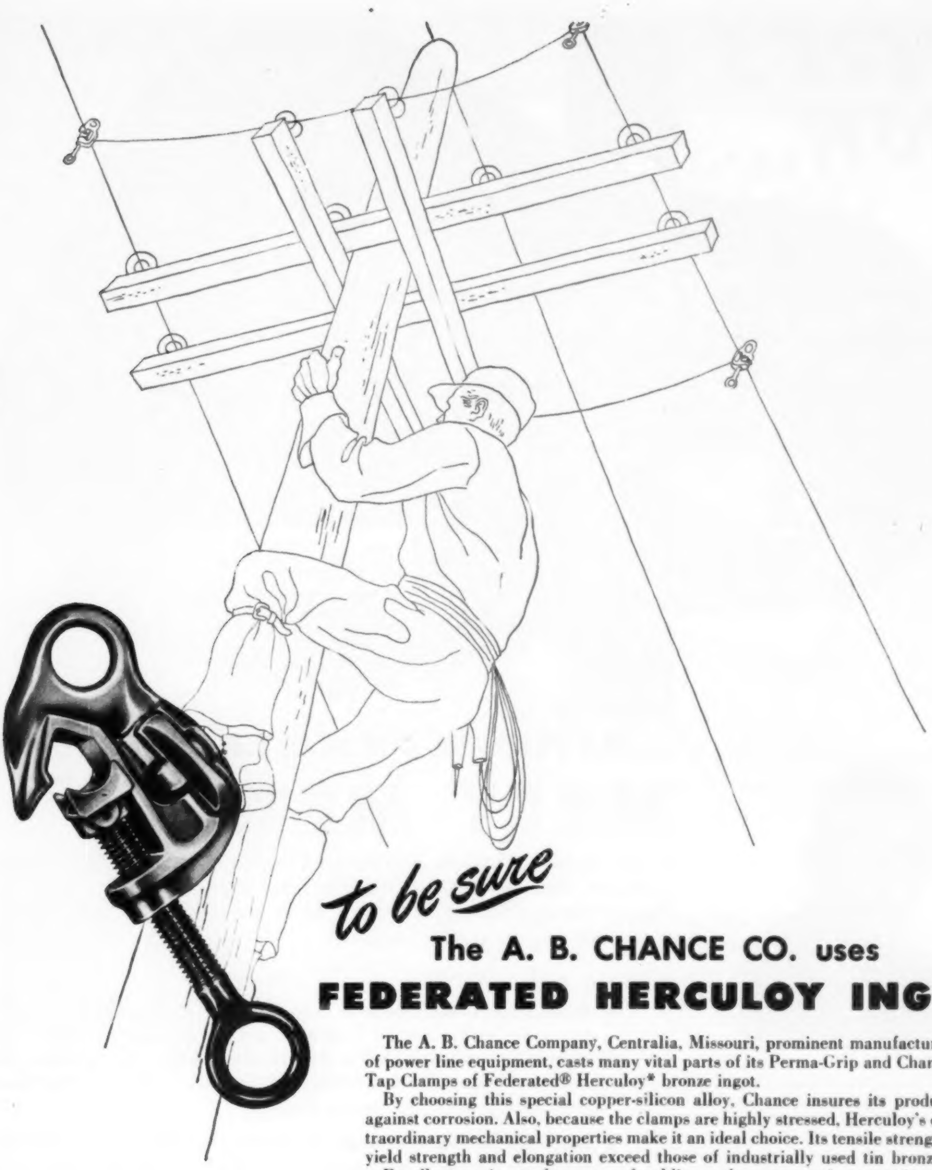
R. J. Ward, of Wagner Malleable Iron Company, Decatur, Ill., reports: "Stevens Liquid Parting has been used in our foundry for 15 years with very excellent results. We have found we can get cleaner molds, resulting in better castings, using Stevens Liquid Parting, especially on small castings."

Mr. Ward's experience is similar to that of hundreds of users of Stevens Liquid Parting. This thin, transparent liquid can be sprayed, swabbed or brushed on patterns or matchplates to form a tough surface film that assures clean parting and smooth casting finish. It's an all-purpose parting, easy and economical to use. And it's non-toxic by contact or inhalation. Order a quantity of Stevens Liquid Parting. You're sure to be pleased with the results. Call your nearest Stevens representative today or write direct.

EVERYTHING FOR A FOUNDRY

FREDERIC B. **STEVENS** INCORPORATED

DETROIT 16, MICHIGAN



to be sure

The A. B. CHANCE CO. uses
FEDERATED HERCULOY INGOT

The A. B. Chance Company, Centralia, Missouri, prominent manufacturer of power line equipment, casts many vital parts of its Perma-Grip and Chance Tap Clamps of Federated® Herculoy* bronze ingot.

By choosing this special copper-silicon alloy, Chance insures its product against corrosion. Also, because the clamps are highly stressed, Herculoy's extraordinary mechanical properties make it an ideal choice. Its tensile strength, yield strength and elongation exceed those of industrially used tin bronzes.

Excellent casting surface, ease of welding and non-magnetic properties are other characteristics of Herculoy which make it fully suitable for the A. B. Chance product.

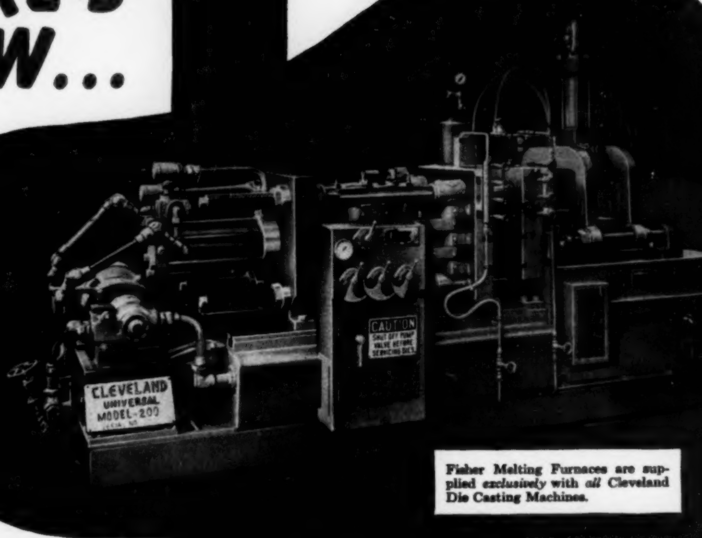
The advantages of Herculoy bronzes are numerous. Some of them could mean better castings for you. Learn more about Herculoy in a free booklet offered by Federated. Write today for your copy.

**Registered Trade Mark of Revere Copper and Brass, Incorporated*

Federated Metals Division

AMERICAN SMELTING AND REFINING COMPANY • 120 BROADWAY, NEW YORK 5, N. Y.

HERE'S HOW...



Fisher Melting Furnaces are supplied *exclusively* with *all* Cleveland Die Casting Machines.

...CLEVELAND DIE CASTING MACHINES

MELT METAL

Fisher Melting Furnaces are supplied *exclusively* with *all* die casting machines manufactured by Cleveland Automatic Machine Company. Fisher Melting Furnaces are *built-in* as an integral part of all Cleveland Automatic *zinc* die casting machines.

John Prohaska, Vice President and Sales Manager of Cleveland Automatic Machine Company says: "We find it a distinct advantage to be able to supply our die casting machine customers with *any* type of melting furnace. It is important to our customers and ourselves that we can ship Cleveland Die Casting Machines as complete packaged units."

For detailed information on Fisher Furnaces write your nearest Fisher or Lindberg office.

HERE'S WHY...

★ **Fisher builds every type of melting furnace**—oil, gas, electric or electric induction for melting aluminum, magnesium, zinc or brass. Thus Cleveland Automatic can supply with their die casting machines, the type of melting furnace best suited to their customer's individual requirements.

★ **The Fisher Service Department is nation-wide**—with Service Men permanently located in or near your city. Maintenance parts are easily and quickly secured.

★ **Fisher Furnaces are standard units**—not special furnaces. They are proven and trouble-free as a result of Fisher's 27 years experience in the manufacture of melting furnaces.

Fisher Furnaces

A DIVISION OF LINDBERG ENGINEERING CO.
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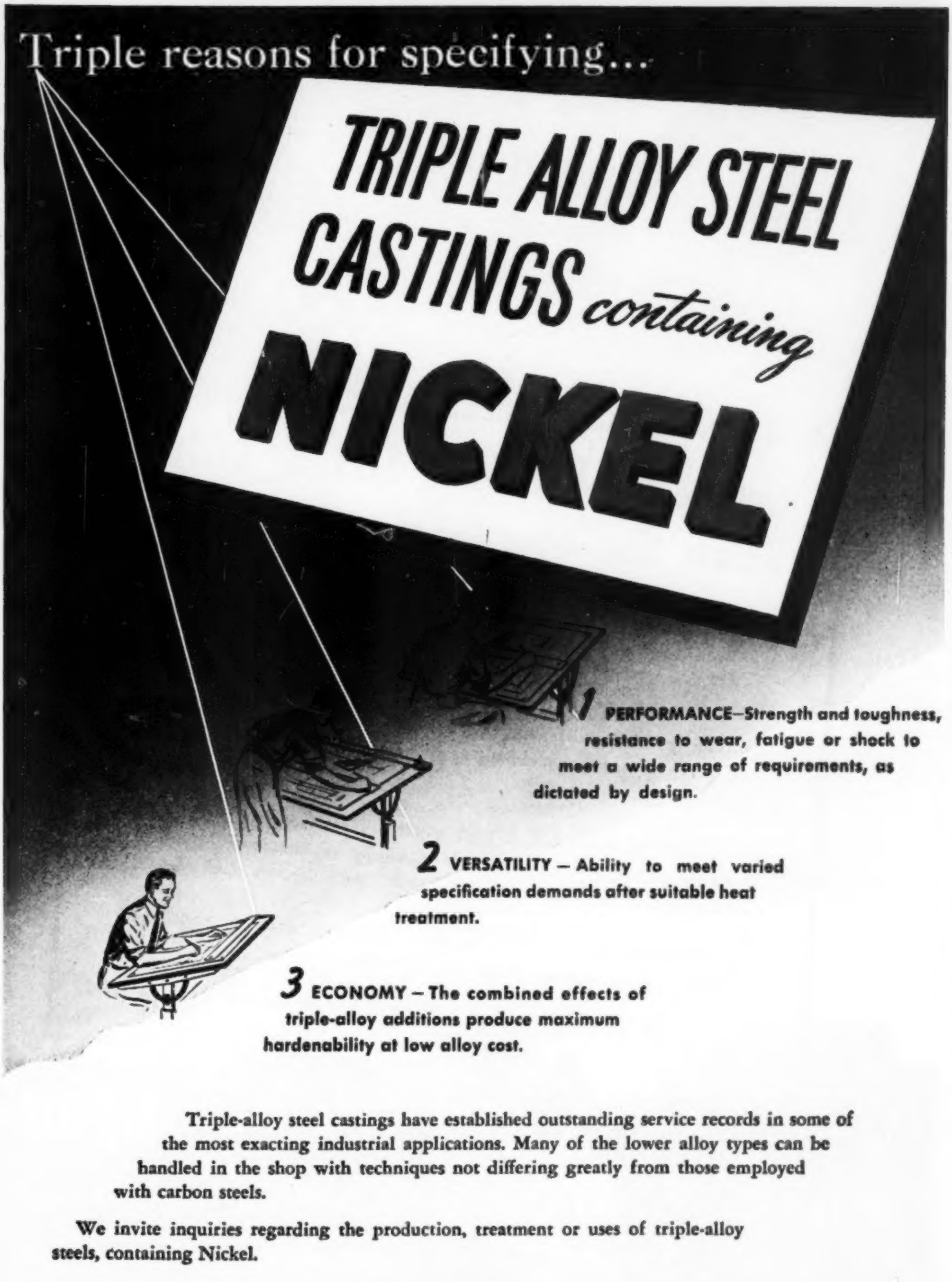
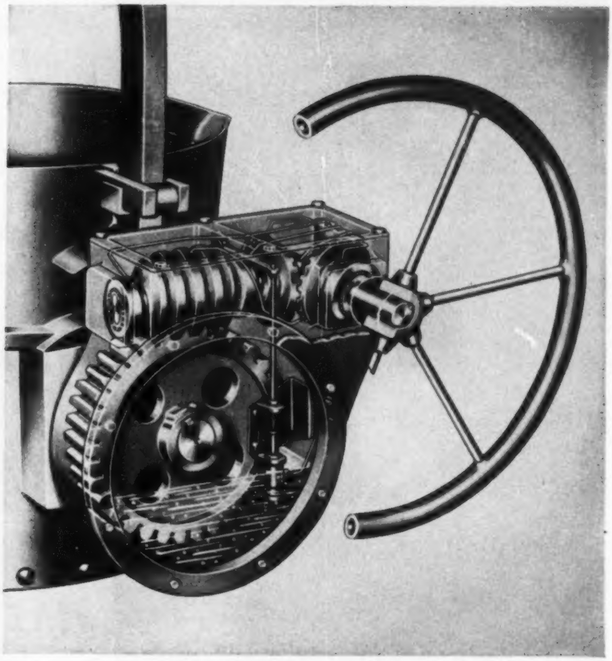

Triple reasons for specifying...
TRIPLE ALLOY STEEL
CASTINGS containing
NICKEL
1 PERFORMANCE—Strength and toughness, resistance to wear, fatigue or shock to meet a wide range of requirements, as dictated by design.
2 VERSATILITY — Ability to meet varied specification demands after suitable heat treatment.
3 ECONOMY — The combined effects of triple-alloy additions produce maximum hardenability at low alloy cost.
Triple-alloy steel castings have established outstanding service records in some of the most exacting industrial applications. Many of the lower alloy types can be handled in the shop with techniques not differing greatly from those employed with carbon steels.
We invite inquiries regarding the production, treatment or uses of triple-alloy steels, containing Nickel.
THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N.Y.

New Worm Ladle Gearing ELIMINATES GASKET ADJUSTMENTS



- Completely enclosed and self contained
- Automatic force-feed lubrication
- Positively self locking in any position
- Precision cut gears

Model 592T ladle with new type gearing. Also notice use of Industrial Equipment's much talked-about UNIVERSAL BAIL. This bail completely eliminates binding due to heat distortion or misalignment. Rigid bail also available.

. . . WORM AND BEVEL GEAR ASSEMBLY COMPLETELY ADJUSTABLE

Here is another Industrial Equipment Company first . . . new, improved worm ladle gearing bringing *complete universal adjustability.*

Take a close look at the phantom view. Here is a one-piece, self-contained unit with all parts easily accessible. Your maintenance man can quickly make back-lash adjustments to pin-point accuracy and positive adjustment by adjusting the bearing lock nuts on all gears and worm. These nuts are easily reached and with working space to spare.

Unaffected by Heat

There is no connection between the bail and the gearing. No clearance for heat distortion is necessary, permitting an assembly almost to machine tool precision.

Industrial's new gearing is absolutely safe and positively self locking. The high ratio between worm and worm gear locks the ladle in any position. Incidentally, worm and bevel gears are of high tensile semi-steel and the worm is of high alloy steel. All are precision cut. Shafts are mounted on anti-friction bearings.

Now Standard Equipment

All Industrial geared ladles are now supplied with this outstanding new type of gearing. In addition, this gearing can be supplied for any Industrial worm geared ladles now in operation. *Write for details.*

Do you have our revised catalog No. 35?

Industrial

EQUIPMENT COMPANY

115 N. Ohio St., Minster, Ohio

LADLES • BOWLS • SHANKS • BAILS • TONGS • SPECIAL EQUIPMENT

FLEDGLING FOUNDRYMEN LOOK TO A.F.S.

A YOUNG MAN starting a career in the foundry industry should consider himself lucky because:

1. It is a fascinating business. It is a stable part of the economy, but is creative and always changing, always progressing.

2. In probably no other industry is there less competition for good jobs. The man starting in one of the traditional engineering fields has thousands upon thousands of competitors. For the engineering graduate, as well as for the apprentice, competition is far less in the foundry, and rewards are as great or greater than in other fields.

3. It provides him with an opportunity to join the American Foundrymen's Society.

Any man entering the foundry industry should consider A.F.S. membership and in doing so will ask himself: "What does A.F.S. have to offer?" The question might well be reversed: "How can one succeed in the foundry industry without the benefits of the Society?"

The beginning foundryman needs to learn the business in general as well as his immediate job. The past history of modern foundry development lies in the TRANSACTIONS OF A.F.S., published annually since 1896 when the Society was founded. Current developments are immediately available in AMERICAN FOUNDRYMAN and current issues of TRANSACTIONS, through other Society publications, through the monthly meetings of the various chapters, and through regional conferences and the Annual A.F.S. Convention.

The apprentice needs recognition and reputation. There is no better way to achieve these than by entering the A.F.S. Apprentice Contest, now in its 28th year. The fortunate winners receive recognition which will help them in the future, in addition to cash awards. Those who do not win at least have shown their immediate superiors that they have real interest in their job and in their industry.

College students may participate directly in A.F.S. through membership in student Chapters which combine educational and industrial contacts through the system of industrial and faculty advisers. Student chapter membership is evidence to any potential employer of early interest in the foundry industry.

As any young man progresses in his industry, he should give to A.F.S. in order to get. This means activity in chapter work, activity on national committees, and preparation of papers for AMERICAN FOUNDRYMAN and for presentation at the Annual Foundry Congress of the Society. Any man on any job can discover something new of interest to the industry. It may be a purely practical development. The industry wants to know of such new things and no man should feel he must write a profound or highly technical paper to command interest and attention in his profession.

Management is seeking capable men for advancement. A record of Society activity is always in favor of any individual in the eyes of management.

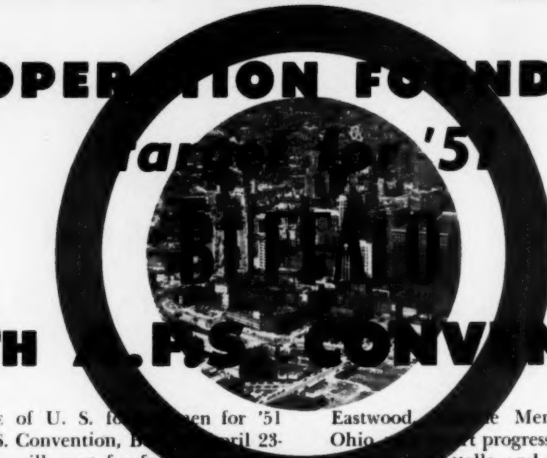
"The Foundry is a *Good* Place to Work" is true for many reasons, but to the man entering the industry for a career, the most important is this: In no other industry can a man advance so far so fast. He needs only to use the facilities and services of the foundry industry's technical organization—the American Foundrymen's Society.

N. J. DUNBECK
National Director
American Foundrymen's Society

Elected a National Director of A.F.S. at the 1947 Annual Meeting, N. J. Dunbeck is chairman of the Board Committee on Research and has served on many of Society's sand committees. He has presented papers on the subject at most A.F.S. chapters and at regional conferences and national conventions. A past chairman of the Central Ohio Chapter, Mr. Dunbeck has been vice-president of Eastern Clay Products, Inc., Jackson, Ohio, since 1936. He is a graduate of Catholic University of America. Summers, while studying for a bachelor of science degree in chemical engineering, he worked in foundries. He established Eastern Clay Products' first laboratory upon going to work there in 1926.

"OPERATION FOUNDRY"

Target for '51



55TH A.F.S. CONVENTION

PRIMARY OBJECTIVE of U. S. fo[illegible]en for '51 will be the 55th A.F.S. Convention, B[illegible]ril 23-26, when foundrymen will meet for fre[illegible] of the technical knowledge that is becoming [illegible]ingly vital as America's casting industry gears itself to meet the steadily growing demands placed upon it by National Defense measures.

Closely scheduled to meet demands of busy foundrymen, the 55th A.F.S. Convention will feature four days of technical sessions, round table discussions and shop courses, so arranged as to avoid conflict of interests wherever possible. Non-ferrous and malleable sessions will be held at the beginning of the Convention week, general interest sessions in the middle of the week, and gray iron and steel sessions at week's end. In this way, those foundrymen with limited time will be able to attend sessions of particular interest within a three-day period.

In addition to the four days of technical sessions, the 1951 Convention program will feature such annual Convention highlights as the A.F.S. Annual Meeting, Charles Edgar Hoyt Annual Lecture, Annual Banquet, Aluminum & Magnesium Round Table Luncheon, Brass & Bronze Round Table Luncheon, Malleable Round Table Luncheon, Pattern Round Table Luncheon, Gray Iron Round Table Luncheon, Steel Round Table Luncheon, Educational Dinner, Canadian Dinner, A.F.S. Alumni Dinner (by invitation only), visitations to Buffalo area foundries and allied industrial plants, a concurrent program of Ladies' Entertainment, and the popular Gray Iron, Sand, and Brass & Bronze Sand Shop Courses, held evenings and open to all foundrymen of the Buffalo area free of charge.

Feature Gating and Risering Symposium

Featured event of the 1951 Convention technical program this year will be a *Symposium on Gating and Risering*, to be held the morning and afternoon of Tuesday, April 24. Aluminum & Magnesium, Brass & Bronze, Gray Iron, Malleable, and Steel Divisions of the Society will jointly sponsor this outstanding discussion by the nation's experts on a timely subject.

Morning session will start at 9:00 and will deal with theoretical aspects of gating and risering. R. F. Thomson, General Motors Corp., Detroit, will preside, introduce authors of papers to be presented, and outline purposes of the Symposium. Following this, L. W. Eastwood, [illegible]e Memorial Institute, Columbus, Ohio, [illegible]t progress of A.F.S. gating and risering [illegible] Battelle, and a representative of Naval Re[illegible] Laboratory, Washington, D. C., will give a resume of fluid flow work done there. Next, Arthur K. Higgins, Allis-Chalmers Mfg. Co., Milwaukee, will discuss *"Considerations in the Feeding of Castings."* Concluding paper of the morning session of the Symposium will be presented by Howard F. Taylor of the Massachusetts Institute of Technology. Each morning session speaker will be limited to 25 minutes, with 10 minutes allowed for discussion of each paper presented.

Afternoon sessions will be in charge of Divisional chairmen and will consist of successive half hour discussions of gating and risering as applied to each Division—Aluminum & Magnesium, Gray Iron, Brass & Bronze, Malleable, and Steel.

Exchange, Hoyt Lectures Scheduled

As in past years, the top technical address of the Convention will be the Charles Edgar Hoyt Annual Lecture, with James C. Zeder, director of engineering and research, Chrysler Corp., Detroit, as speaker. Also featured on the Convention's technical program will be the Exchange papers of the Institute of British Foundrymen and the Institute of Australian Foundrymen. E. S. Renshaw, head foundry metallurgist, Ford Motor Co., Ltd., Dagenham, England, will present the IBF Exchange Paper on *"Basic Cupola Melting and Its Possibilities,"* and R. Dyke, Defence Research Laboratories, Marybirnong, Victoria, will present the Australian Exchange Paper to the 1951 A.F.S. Convention, *"The Modification Technique of Aluminum-Silicon Alloys."*

Aluminum & Magnesium Division will open its two-day technical program with a morning technical session, the Aluminum & Magnesium Round Table Luncheon, and a late afternoon technical session on Monday, April 23. The Division's program on Tuesday, April 24, will include participation in the *Symposium on Gating and Risering* in the morning and afternoon and a technical session that afternoon.

Brass & Bronze Division's technical program will open Monday morning, April 23 with a technical session, followed by the Brass & Bronze Round Table Luncheon and a late afternoon technical session. In the evening, the first of two Brass & Bronze Sand Courses will be held. On Tuesday, the Division will

participate from 9:00 a.m. to 12:00 noon and from 2:00 p.m. to 4:00 p.m. in the *Symposium on Gating and Risering*. Concluding the Division's technical program will be the second and final Brass & Bronze Sand Course at 8:00 p.m.

Malleable Division will open its two-day technical program with sessions at 10:00 a.m., 2:00 p.m. and 4:00 p.m. on Monday, April 23. On Tuesday, April 24, the Division will participate in the first half of the *Symposium on Gating and Risering* in the morning, followed by the Malleable Round Table Luncheon, and will conclude its two-day program with the afternoon session of the gating and risering symposium.

Educational Division will begin its program with a technical session the afternoon of April 23, followed by the annual Educational Dinner at 6:30 p.m. that evening. The morning technical session will be divided into two topics: (1) Industry—"*Apprentice Training*," and (2) Education—"*Trade School*." Again at the Educational Dinner, two talks will be featured: (1) Industry—"*Absorbing the Technical Trainee*," and (2) Education—"*Developing Students for Industry*."

Three-Day Gray Iron Program

Scheduled for the Gray Iron Division on Monday, April 23, the first of three Gray Iron Shop Courses, will be devoted to "*Air in the Cupola*." Held in the evening, these courses are open to all local foundrymen as well as Convention attendants without charge. The Division's program will get into full swing with participation in the *Symposium on Gating and Risering* the morning and afternoon of Tuesday, April 24. Concluding the program for the day will be a Gray Iron Shop Course session on "*Melting Iron in a Reverberatory Type Furnace*."

On April 25 the Gray Iron Division has scheduled a technical session at 10:00 a.m. and the final Gray Iron Shop Course, on "*Metal Pouring Temperature Control*," in the evening. Concluding the Division's program will be one morning and two afternoon technical sessions and the Gray Iron Round Table Luncheon.

Sand Division will launch its Convention program with the first of three Sand Shop Courses, open to all foundrymen, Monday evening, April 23. First Sand Division technical session will be held at 4:00 p.m., Tuesday, April 24, following the *Symposium on Gating and Risering*. At 8:00 p.m. the second Shop Course will be held. Final day's program will consist of technical sessions Wednesday morning and afternoon, April 25, and the last Sand Shop Course in the evening.

Steel Division's program will begin with participation in the *Symposium on Gating and Risering* the morning and afternoon of Tuesday, April 24. Next event on its schedule will be a technical session the morning of Thursday, April 26, followed by the Steel Round Table Luncheon and two more technical sessions in the afternoon, concluding its program.

Pattern Division will launch its Convention technical program with a session at 4:00 p.m., Tuesday, April 24. Second and final Divisional event will be the Pattern Round Table Luncheon, April 25.

General Foundry Interest Sessions Scheduled

Meetings of general foundry interest will begin with morning and afternoon sessions on Heat Transfer on Monday, April 23. On Tuesday, April 24, the Timestudy & Methods Committee will hold a session at 4:00 p.m.; the A.F.S. Foundry Cost Committee a session at 10:00 a.m., April 25, the Plant & Plant Equipment Committee afternoon and evening sessions on April 25, and the A.F.S. Refractories Committee a session at 4:00 p.m., Wednesday, April 25.

Scheduled Convention highlights include the Canadian Dinner at 7:00 p.m., Tuesday, April 24; the Annual Business Meeting of A.F.S. at 2:00 p.m., Wednesday, April 25, followed by the Charles Edgar Hoyt Annual Lecture, and at 7:00 p.m. the A.F.S. Alumni Dinner (by invitation only). Concluding the Convention will be the A.F.S. Annual Banquet.

Buffalo Convention Bureau reports receiving a substantial number of housing applications to date, indicating that 1951 A.F.S. Convention registration will be heavy for a non-exhibit year. A.F.S. members who have not already done so are requested to submit their housing applications to the Buffalo Convention Bureau, on forms mailed to the membership in January, at the earliest possible date.

This scenic bridle path in Buffalo's beautiful Delaware Park is but one of the attractions that make the Buffalo area renowned for its scenery. Other points of interest in and around the city are world-famed Niagara Falls, with its Cave of the Winds and Whirlpool State Park; the Tonawanda Indian Reservation and the International Peace Bridge across the Niagara River.

COSTS vs. BENEFITS of OXYGEN-ENRICHED CUPOLA MELTS

Fred Carl
Metallurgist
Allison-Bedford Foundry, General Motors Corp.
Bedford, Ind.

Use of oxygen in conjunction with the air blast has been proved by a number of investigators to be an outstanding factor in overcoming poor cupola melting performance resulting from a postwar shortage of good grade foundry coke. Since the cupola is the most widely-used furnace for melting gray iron and in many instances is used as an auxiliary furnace for melting malleable iron, factors affecting its performance are highly important in the production of relatively low-cost cast iron.

To overcome cupola melting problems caused by the postwar shortage of good coke—such difficulties as low tapping temperatures, decreased output, and a generally poor melting performance both with regard to quantity and quality—research has been undertaken in recent years to improve operating performance through use of oxygen in the cupola.

In most cases these experiments have had favorable results, but unfortunately most of the reported work has been done with small cupolas and may or may not be of value in larger furnaces. A few tests have been reported using 19, 48 and 72-in. melting zone cupolas. To compare the use of oxygen in varying cupola sizes, the following reports were reviewed and will be compared in summarized charts:

1. W. C. Wick, Armour Research Foundation, "*Oxygen Enriched Cupola Blasts,*" A.F.S. Transactions, vol. 56, pp. 246-259 (1948). (19-in. cupola).
2. E. S. Clark, "Added O_2 Improves Cupola Output," *Iron Age*, May 4, 1950. (48-in. cupola).
3. F. J. Webbere, "*Auxiliary Oxygen in a 72-in. Production Cupola,*" American Foundryman, vol. 17, No. 6, June 1950, pp. 40-44.

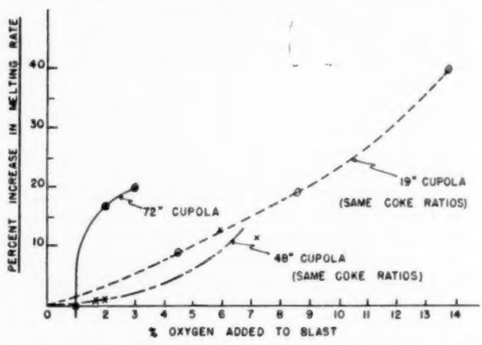


Fig. 1—Chart showing effect of oxygen additions on melting rates of the 19, 48 and 72 in. cupolas

Tests Give Melting, Tapping Data

Oxygen used in enriching the blast was produced by generating units for the work done in the 19 and 48-in. cupolas, while in the test of the 72-in. cupola, large mobile tanks were used as an oxygen source. In the case of the 19 and 48-in. cupolas, tests were of relatively short duration in comparison with the operating time of the 72-in. cupola. All tests, however, were of sufficient time to produce reliable data regarding melting rate, tapping temperature, coke savings, etc.

It is interesting to note (Fig. 1) that all three investigators report favorable increases in melting rates with oxygen additions. The 19-in. cupola investigation report indicates melting increases up to 40 per cent, but to attain that figure such large amounts of oxygen would be required that the process would be of doubtful economic value.

The 72-in. production cupola investigation indicates no increase in melting rate with 1 per cent oxygen, but with 2 or 3 per cent added oxygen, melting rates can increase up to 20 per cent.

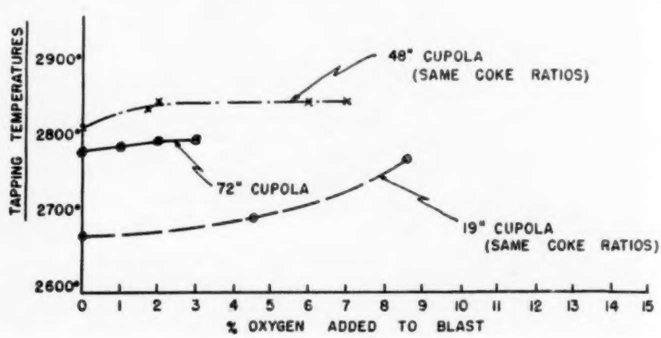


Fig. 2—Effect of oxygen additions on tapping temperatures of 19, 48 and 72-in. cupolas. Note that greatest temperature increase is shown for the 19-in. cupola, least increase for 72-in. cupola.

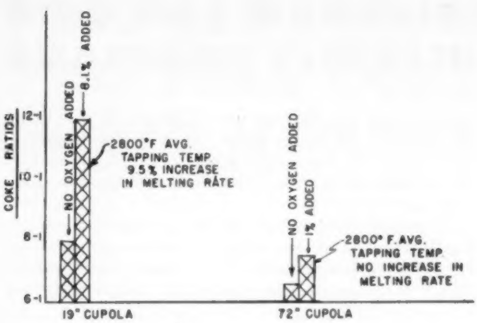


Fig. 3—Comparative coke savings effected by use of oxygen additions in 19, 48 and 72-in. cupolas.

In reviewing data on the effect of added oxygen on increased tapping temperature (Fig. 2), the greatest increase in temperature is reported with the 19-in. cupola and the least with the 72-in. cupola. This can be partially explained by the fairly low temperature level produced by the 19-in. cupola without added oxygen, whereas the normal operating temperature of the 72-in. cupola was 2800 F without added oxygen.

Figure 3 graphically indicates what may be accomplished in coke savings by the use of oxygen added to the blast. In the case of the 72-in. cupola, savings in coke amounted to 7.2 tons in the production of 384 tons of iron, with the addition of 1 per cent oxygen.

Report Little Chemical or Physical Change

No drastic chemical changes were reported by any of the investigators. Wick and Clark, however, report less silicon loss and lower sulphur content. Little change in physical properties, chilling characteristics, or fluidity is reported.

All three investigators noted improvement in the bridging characteristics of the cupolas, cleaner melting, and less slag at the tuyeres. No increase in burnout was reported.

In attempting to draw conclusions as to the economic possibilities of this process, it is first necessary to obtain an accurate estimate of the cost of oxygen involved. Figure 4 summarizes graphically the probable cost of oxygen addition per ton of iron melted, based on oxygen cost figures used by W. C. Wick. Cost figures shown in Fig. 4 for the 48 and 72-in. cupolas are based on one cupola operating 16 hours a day. Possible coke savings have been disregarded in this chart, since little or no coke savings were indicated in the report on the 72-in. cupola with 2 and 3 per cent additions.

In summarizing the three reports, it appears that while there are distinct advantages in the use of oxygen enrichment, its universal application to the foundry industry is still of doubtful economic advantage. Further study of storage facilities, generating units, and lowered unit cost seems to be indicated before oxygen additions to the cupola can be applied generally in the foundry industry.

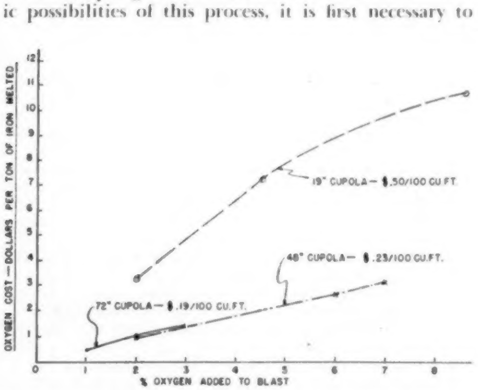


Fig. 4—Comparative cost of oxygen in dollars per ton of iron melted in the 19, 48 and 72-inch cupolas.

Gray Iron And Educational Divisions Plan '51 A.F.S. Convention Programs

Two MEETINGS were recently held by A.F.S. technical committees to formulate program plans for the 1951 A.F.S. Convention, to be held April 23-26 in Buffalo. First of these was a meeting of the Educational Division's Executive Committee in Chicago on October 27; the second a meeting of the Gray Iron Division's Shop Course Committee, held November 10 at Michigan State College, East Lansing.

All levels of education will be considered in the Educational Division's Convention program, the Executive Committee decided. Feature of this program will be the annual Educational Dinner, which will have two principal talks—one on *"Absorbing the Technical Trainee,"* and the other on *"Developing the Student for Industry,"* with speakers to be selected in the near future. Educational Division's single technical session will cover high school, trade school and apprentice school levels of education and will reflect views of both industrialists and educators interested in the foundry industry.

Also reported at this session were progress of the 1951 A.F.S. Apprentice Contest and the A.F.S. Apprentice Training Program. It was unanimously voted to appoint Professor William N. Ruten, Polytechnic Institute of Brooklyn chairman of the A.F.S. Textbook Committee, succeeding Professor George J. Barker of the University of Wisconsin, newly-appointed chairman of the A.F.S. Educational Division.

A.F.S. Gray Iron Division Shop Course Committee, under the chairmanship of Kenneth H. Priestley, Vassar Electrology Products, Inc., Vassar, Mich., has tentatively scheduled three of the popular evening shop course sessions for the 1951 Convention. First of these will be held at 8:00 p.m., April 23, and will be on *"Air in the Cupola"*; second, to be held the following evening, will deal with *"Melting Gray Iron in a Reverberatory Furnace"*; third and final session will be held at 8:00 p.m., April 25, and will deal with *"Metal Pouring Temperature Control."* Speakers and session chairmen will be announced at a later date. As in past years, Gray Iron Shop Course sessions are open free-of-charge to all local foundrymen, in addition to Convention attendants.

RELEASE COMPLETE BIRMINGHAM AND OHIO REGIONAL FOUNDRY CONFERENCE PROGRAMS

PROGRAMS for the Birmingham Regional and Ohio Regional Foundry Conferences have been finalized and announced by C. K. Donoho, American Cast Iron Pipe Co., and by S. E. Kelly, Eberhard Mfg. Co., program chairman and chairman of the respective conferences.

The 19th Annual Birmingham Regional Foundry Conference will be held at the Tutwiler Hotel, Birmingham, February 22-24, under the sponsorship of the A.F.S. Birmingham District Chapter. In Cleveland, March 9 and 10, the Fourth Ohio Regional Foundry Conference will be held at Case Institute of Technology and the Tudor Arms Hotel. The Ohio Regionals were initiated with the first of the series at Case in 1948. Sponsors are the five Ohio A.F.S. Chapters—Northeastern Ohio, Central Ohio, Toledo, Cincinnati District and Canton District.

To Install Alabama Student Chapter

Prior to the Birmingham Conference, A.F.S. National President Walton L. Woody, National Malleable & Steel Castings Co., Cleveland, and A.F.S. Secretary-Treasurer Wm. W. Maloney will install the year-old University of Alabama Student Chapter at a luncheon at the University on February 21. Birmingham District Chapter officers and directors will participate in the installation and will hold a pre-conference dinner meeting with A.F.S. National Officers and conference speakers.

Program for the 19th Birmingham Regional Foundry Conference, which includes a full day and a half for plant visitations, is as follows:

Thursday, February 22

9:00 a.m. REGISTRATION. Lobby of Tutwiler Hotel.

10:00 a.m. TECHNICAL SESSION. *"Engineering Properties of Gray Iron for Foundrymen,"* T. E. Eagan, Cooper-Bessemer Corp., Grove City, Pa.

12:30 p.m. LUNCHEON. *"Asset or Liability,"* A.F.S. National President Walton L. Woody and A.F.S. National Secretary-Treasurer Wm. W. Maloney.

2:00 p.m. TECHNICAL SESSION. *"Foundry Developments as General Motors Sees Them,"* L. A. Danse, Production Engineering Section, General Motors Corp., Detroit.

3:30 p.m. TECHNICAL SESSION. Showing of the A.F.S. sound-color film, *"Fluid Flow in Transparent Molds—II."*

7:00 p.m. ANNUAL BANQUET. *"Man to Man on the Job,"* Ralph L. Lee, General Motors Corp., Detroit.

Friday, February 23

9:00 a.m. PLANT VISITATIONS. More than 20 Birmingham area plants will be open for inspection.

2:00 p.m. TECHNICAL SESSION. *"Studies in Improvement of the Machinability of High Phosphorus Gray Iron,"* W. W. Austin, Southern Research Institute, Birmingham.

3:30 p.m. TECHNICAL SESSION. *"Zirconium for Manganese in Gray Cast Iron,"* Warren C. Jeffrey, University of Alabama.

8:00 p.m. Entertainment. Tutwiler Hotel Ballroom.

Saturday, February 24

9:00 a.m. PLANT VISITATIONS.

Fourth Ohio Regional Foundry Conference, during its two-day technical meeting, March 9 and 10, will stress the theme, *"Basic Approaches to Foundry Problems."* Four technical sessions, two the afternoon of March 9 and two the morning of March 10, will make up the bulk of the program. Each of these sessions will consist of concurrent sectional meetings on Patternmaking, Gray Iron, Non-Ferrous, Malleable Iron and Steel.

Conference highlights will include the keynote address, delivered at the opening Conference session by Harry W. Dietert, Harry W. Dietert Co., Detroit; March 9 luncheon, with George K. Dreher, Foundry Educational Foundation, Cleveland, as speaker; a social hour at the Tudor Arms Hotel and the Conference Dinner, both the evening of March 9; and the concluding Conference Luncheon on March 10. Also scheduled is a breakfast for Ohio State University engineering graduates Saturday morning, March 10.

Friday, March 9

9:00 a.m. REGISTRATION. Lobby of Tudor Arms Hotel.

10:30 a.m. OPENING SESSION. Speakers: S. E. Kelley, Eberhard Mfg. Co.; Dr. K. H. Donaldson, Head, Mechanical Engineering, Case Institute of Technology; and Harry W. Dietert, Harry W. Dietert Co., Detroit, keynote address, *"Basic Approach to Foundry Sand Control."*

1:00 p.m. LUNCHEON. Case Institute of Technology.

2:30 p.m. SECTIONAL MEETINGS.

Patternmaking—Franz Schumacher, Cooper Alloy Foundry Co., Hillside, N. J., *"Metal Spraying as It Affects the Pattern Shop."*

Gray Iron—H. H. Wilder, Vanadium Corp. of America, Detroit, *"Cupola Operation in a Permanent Mold Foundry."*

Non-Ferrous—Subject and speaker to be announced.

Malleable Iron—Ralph Hasset, Texas Foundries, Inc., Lufkin, Texas, *"Job Shop Coreblowing."*

Steel—C. K. Donoho, American Cast Iron Pipe Co., Birmingham, Ala., *"Quality of Steel for Castings."*

4:00 p.m. SECTIONAL MEETINGS.

Patternmaking—Elmer Blake, Osborn Mfg. Co., *"Design of Core Boxes and Driers for Use on Coreblowing Machines, Including Size and Number of Blowholes and Vents."*

Gray Iron—W. A. Geisler, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., *"Shell Molding."*

Non-Ferrous—Subject and speaker to be announced.

Malleable Iron—Fitz Coghlin, Jr., Albion Malleable Iron Co., Albion, Mich., *"Duplex Melting."*

Steel—C. E. Sims, Battelle Memorial Institute, Columbus, *"Some Things We Know and Don't Know About Cast Steel."*

6:00 p.m. SOCIAL HOUR. Tudor Arms Hotel.

7:30 p.m. CONFERENCE DINNER. Speaker: Col. Jack Major.

Saturday, March 10

9:00 a.m. REGISTRATION. Lobby of Tudor Arms Hotel.

9:30 a.m. SECTIONAL MEETINGS.

Patternmaking—George D. Weber, Weber Gage Co., *"Measurements and Their Importance to the Patternmaker."*

Gray Iron—R. A. Flinn, American Brake Shoe Co., Mahwah, N. J., *"Basic Relations Between Castings and Test Bars."*

Non-Ferrous—Subject and speaker to be announced.

Malleable Iron—Victor Paschkis, Columbia University, "Uniformity Requirements of Heat Treating Furnaces."

Steel—T. N. Armstrong, International Nickel Co., *"Factors Affecting the Quality of Cast Steel."*

11:00 a.m SECTIONAL MEETINGS.

Patternmaking—Subject and speaker to be announced.

Gray Iron—John B. Caine, Consultant, Cincinnati, *"Time—the Basic Foundry Problem."*

Non-Ferrous—Subject and speaker to be announced.

Malleable Iron—Ray Witsche, A. P. Greene Fire Brick Co., *"Basic Approach to Malleable Refractories."*

Steel—Subject and speaker to be announced.

1:00 p.m. LUNCHEON. Case Institute of Technology.

PLEDGES REACH TWO-YEAR GOAL IN SIX MONTHS

An estimated 4,000 members and friends of the Society have expressed enthusiastic support of plans for a permanent A.F.S. home by boosting Building Fund contributions over the two-year goal within a few months of the three-year Project's inception. Aside from several hundred individual members, firms and foundry organizations whose names have been listed as Charter subscribers in recent months, thousands of members have contributed to the Fund through their Chapters. Other members desiring to become Charter Subscribers are requested to mail contributions to The Secretary, American Foundrymen's Society, 616 S. Michigan, Chicago 5.

CHARTER SUBSCRIBERS

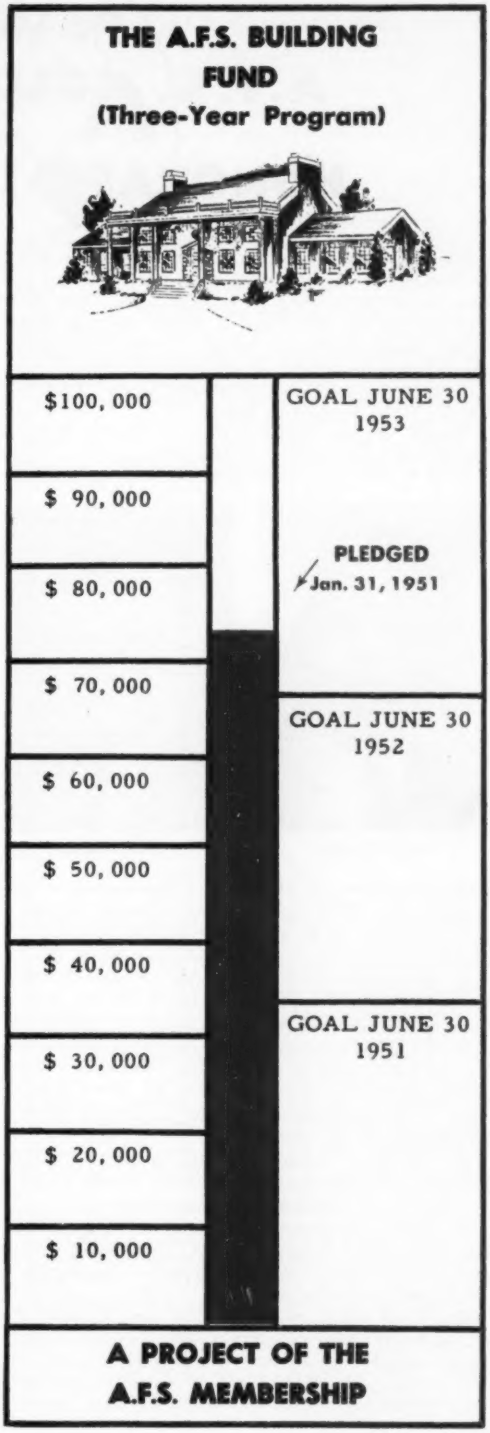
(December 31, 1950-January 31, 1951)

Pledges of Individuals

T. P. Barnefield, James B. Clow & Sons, Chicago.
L. C. Farquhar, Sr., American Steel Foundries, Inc., East St. Louis, Ill.
J. A. Gitzen, Delta Oil Products Co., Milwaukee.
Daniel J. Jones, Bridgeton Pike Co., Millville, N. J.
R. P. Klumb, Delta Oil Products Co., Milwaukee.
Joseph L. Kral, International Harvester Co., Chicago.
Peter E. Kyle, Cornell University, Ithaca, N. Y.
Dr. James T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.
Peter E. Rentschler, Hamilton Foundry & Machine Co., Hamilton, Ohio.
Milton Tilley, National Malleable & Steel Castings Co., Cleveland, Ohio.
E. C. Troy, Riverton, N. J.
Bertrand R. Warmeling, National Malleable & Steel Castings Co., Cleveland, Ohio.
C. Neal Wilcox, Electric Steel Foundry Co., Portland, Ore.
S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, Minn.

Pledges of Companies

Albion Malleable Iron Co., Albion, Mich.
American Brake Shoe Co., New York, N. Y.
American Steel Foundries, Chicago.
Buckeye Steel Castings Co., Columbus, Ohio.
Carondelet Foundry Co., St. Louis, Mo.
Chicago Malleable Castings Co., Chicago.
Continental Gin Co., Birmingham, Ala.
Dayton Malleable Iron Co., Dayton, Ohio.
Electric Steel Foundry Co., Portland, Ore.
Electro Metallurgical Division, Union Carbide & Carbon Corp., New York.
Elesco Smelting Corp., Chicago.
J. A. Gosselin Co., Ltd., Drummondville, Que., Canada.
Herman Pneumatic Machine Co., Pittsburgh.
Kencroft Malleable Co., Inc., Buffalo, N. Y.
Long Beach Iron Works, Long Beach, Calif.
Lufkin Foundry & Machine Co., Lufkin, Texas.
Martin Engineering Co., Kewanee, Ill.
Mathews Conveyor Co., Elwood City, Pa.
McWane Cast Iron Pipe Co., Birmingham, Ala.
National Cast Iron Pipe Co., Birmingham, Ala.
Pratt & Letchworth Co., Buffalo, N. Y.
Racine Aluminum & Brass Foundry, Racine, Wis.
H. B. Smith Company, Inc., Westfield, Mass.
Tabor Mfg. Co., Philadelphia.
Terre Haute Malleable & Mfg. Corp., Terre Haute, Ind.
Woodward Iron Co., Woodward, Ala.



NAME 1951

A.F.S. GOLD MEDALISTS and HONORARY LIFE MEMBERS

SIX OF THE NATION'S OUTSTANDING FOUNDRYMEN will be honored at the Annual Banquet of the 55th A.F.S. Convention, to be held in Buffalo, April 23-26. Selected by the Society's Board of Awards and approved by the Board of Directors during their mid-year meeting, recipients and their awards are:

John A. Penton Gold Medal—to Victor A. Crosby, Climax Molybdenum Co., Detroit.

Peter L. Simpson Gold Medal—to Thomas W. Curry, Lynchburg Foundry Co., Lynchburg, Va.

John H. Whiting Gold Medal—to Alfred Boyles, United States Pipe & Foundry Co., Burlington, N. J.

V. A. Crosby

Alfred Boyles

A.F.S. GOLD MEDALISTS

T. W. Curry

Honorary Life Memberships in the American Foundrymen's Society to E. W. Beach, retired, Nantucket, Mass.; Edward J. McAfee, Puget Sound Naval Shipyard, Bremerton, Wash.; and Walton L. Woody, National Malleable & Steel Castings Co., Cleveland, president of American Foundrymen's Society.

Mr. Crosby is recommended by the Board of Awards for the A.F.S. John A. Penton Gold Medal for *"outstanding service to the Society and for his contributions to the dissemination of information relating to ferrous foundry metallurgy."*

Mr. Boyles is designated to receive the John H. Whiting Gold Medal for *"fundamental studies on the mechanism of graphitization of gray cast iron."*

Mr. Curry's recommendation for the Peter L. Simpson Gold Medal is based on his *"outstanding work and contributions to the field of sand technology in the foundry industry."*

Mr. Beach will be made an Honorary Life Member of the Society for *"outstanding contributions to the Society and to the industry in the field of foundry engineering."* Mr. McAfee will be similarly honored for *"outstanding service to the Society and to the foundry industry in the development of patternmaking materials and applications."* A.F.S. National President Walton L. Woody will receive Honorary Life Membership in the Society upon completion of his term.

Nominations for recipients of A.F.S. Gold Medals may be made by members of past or present Boards of Awards, any elected Society officer, the Board of Directors, the Executive Committee of any of the American Foundrymen's Society technical divisions or general interest committees, or by any member of the Society, execept apprentice or student members.

Alfred Boyles

Alfred Boyles, who will receive the A.F.S. John A. Penton Gold Medal for his work on graphitization of gray cast iron, since his graduation from the University of North Carolina in 1924 has specialized in fundamental research in metallurgy and metallography of cast iron and has published many works on the subject. Mr. Boyles began his career as chemist for the Tennessee Coal, Iron and Railroad Co., Birmingham, Ala., in 1924, leaving there to become a member of the staff of Battelle Memorial Institute, Columbus, Ohio, where he was, successively, test engineer and research metallurgist. In 1941 Mr. Boyles joined the Research and Development department of the United States Pipe & Foundry Co., Burlington, N. J. He is the author of *The Structure of Cast Iron*, published by American Society for Metals.

Victor A. Crosby

Victor A. Crosby, named to receive the A.F.S. John A. Penton Gold Medal for dissemination of information on ferrous foundry metallurgy, is chairman of the A.F.S. Gray Iron Division. A graduate of Mississippi State College, he joined Dodge Bros. Co., Detroit, in

1916, leaving there in 1917 to serve as a Second Lieutenant in World War I. Upon discharge, Mr. Crosby became foundry metallurgist and later chief metallurgist for Packard Motor Car Co., Detroit. He resigned that position to become foundry metallurgist for Studebaker Corp., South Bend, Ind., for 12 years, before assuming his present position as metallurgical engineer for Climax Molybdenum Co., Detroit, in 1934. Active in A.F.S. committee work for many years, Mr. Crosby has presented papers before technical societies on a variety of subjects, including core oils, sand control and production of high test iron and alloy cast iron.

Thomas W. Curry

Thomas W. Curry, who will be awarded the A.F.S. Peter L. Simpson Gold Medal for his work in the field of sand technology, is widely-known to the Society's membership for his frequent appearances as a speaker at A.F.S. chapter, regional and national meetings and for his many contributions to the technical and trade press. Holder of a B. S. in metallurgical engineering from Pennsylvania State College in 1932, Mr. Curry became metallurgist for the Kennedy Van Saun Mfg. Corp., Danville, Pa., that year. After a two-year period as foundry methods engineer for the York Corp., York, Pa., he returned to Kennedy Van Saun as foundry superintendent and in turn, returned to the York Corp. as assistant foundry superintendent. In 1943, Mr. Curry assumed his present position as metallurgist for the Lynchburg Foundry Co., Lynchburg, Va., where he has been instrumental in developing chemical treatments for molding sands and resin core mixtures.

HONORARY LIFE MEMBERS

E. W. Beach

E. J. McAfee

Walton L. Woody

E. W. Beach

Veteran foundryman E. W. Beach has long played a prominent role in the field of foundry engineering and management. Born in Waterbury, Conn., and educated in London, England, Mr. Beach first entered the foundry industry as an apprentice at the Waterbury-Farrell Foundry & Machine Co., Waterbury, Conn., in 1891, remaining with that organization as a draftsman until 1899. After two years as an executive of a company in an allied metals manufacturing field, Mr. Beach formed the Manufacturers Foundry Co., serving as president and general manager until 1918, when he became president and manager of Farrel Machine & Foundry Co., Cleveland. Leaving there in 1922, Mr. Beach served for two years as vice-president of Warren Foundry Co., Warren, Ohio, before joining Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich. Prior to his retirement last year, Mr. Beach served for almost a quarter-century as executive engineer and metallurgical consultant for Campbell, Wyant & Cannon and during this period made many notable contributions to the science of ferrous metallurgy. He was for many years active in technical and chapter work for the Society.

Edward J. McAfee

Edward J. McAfee, who will receive Honorary Life Membership in the American Foundrymen's Society for development of patternmaking materials and applications, is equally well-known to Society members for his work in encouraging young men to enter the foundry industry. Active in the formation of the A.F.S. Washington Chapter, he has served on its Board of Directors and heads its Apprentice Contest Committee, and is a member of the A.F.S. National Apprentice Contest Committee. Mr. McAfee began his career as a patternmaker with Portland Iron Works, Portland, Ore., in 1907, remaining there until 1916, when he became a patternmaker for Puget Sound Naval Shipyard, Bremerton, Wash. Master Patternmaker at the Shipyard since 1938, Mr. McAfee was awarded the Navy's Meritorious Civilian Award in 1949 for producing new patternmaking methods that materially aided U. S. war efforts. A frequent speaker before A.F.S. meetings, he is the author of many articles on patternmaking and co-author of the *Patternmaker's Manual*, published in 1946 by the Patternmakers' League of North America.

Walton L. Woody

Services of A.F.S. National President Walton L. Woody, vice-president and general manager, National Malleable & Steel Castings Co., Cleveland, to the Society have been long and valuable. In recognition of his work as first chairman of the A.F.S. Northeastern Ohio Chapter, as a National Director, Vice-President and President of A.F.S., Mr. Woody will be awarded an Honorary Life Membership in the Society.

Questions — THE ROUND TABLE — Answers

WHAT TO DO ABOUT AIR POLLUTION

FOUNDRY DUST CONTROL PROBLEMS

John M. Kane
Manager, Dust Control Div.
American Air Filter Co., Louisville

Air pollution, as related to dust and fume emission from industrial processes may be classified into two basic groups—public nuisance and air pollution. Foundry dust and fumes are in both classes, and this article will deal mainly with foundry problems introduced by the growing emphasis on air pollution abatement, and the approaches made toward setting control standards.

Public nuisance complaints are usually caused by the dropping of relatively large particles (10 microns size might be used as a dividing line) into the nearby air of an industrial plant, causing the well publicized problems of deposition on cars, porches, window sills, and laundry.

Smaller particles in heavy concentrations (such as the 2 to 5 grain loading escaping primary collectors on many sand dryers) can cause the same offense. Under unfavorable weather conditions and/or plant locations, fine particles in low to moderate quantities (such as zinc oxide fumes from brass melting furnaces) will hang at ground level instead of rising into the atmosphere and dispersing.

Collection equipment is available at reasonable cost to eliminate most of the public nuisance type of air pollution problems caused by coarse particles from foundry or other industrial stacks.

Fine particles ranging from minus 10 microns down through the submicron sizes of metal fumes and the smokes are involved in what might be called the "air pollution" group. It is such fine material that stays is suspension for long periods and which, under unfavorable meteorological conditions, can accumulate, stratify at or near ground level, and cause the perplexing smog problem.

Many processes produce such fine particles in the presence of high temperature gases, making the collection problem expensive and control far from complete. Air pollution regulations covering such problems must be based on attainable results with present day control equipment which can be installed and maintained at reasonable cost. The complexity of conditions and the large number of variables from one industry to another make the question of reasonable standards a baffling engineering problem.

For lack of an engineering answer to the problems, existing regulations designed for coal burning combustion gases have been extended to include other industrial processes. The classic 0.4 grains per cubic foot was established by the ASME as a reasonably attainable maximum for helping the "public nuisance" problem from fly ash released through coal burning boiler stacks.

The Ringlemann Chart of visual comparisons was set up as a reasonably attainable maximum for the

A panel discussion on all phases of air pollution was a feature of the 1950 Michigan Regional Foundry Conference held at Michigan State College, East Lansing, Mich., Nov. 10-11, 1950. Three of the six discussions presented at the meeting—public health, control equipment, legal factors—appear in this issue of AMERICAN FOUNDRYMAN. The subjects of meteorology, plant life and pathology, and testing procedures will be presented in the March 1951 issue.

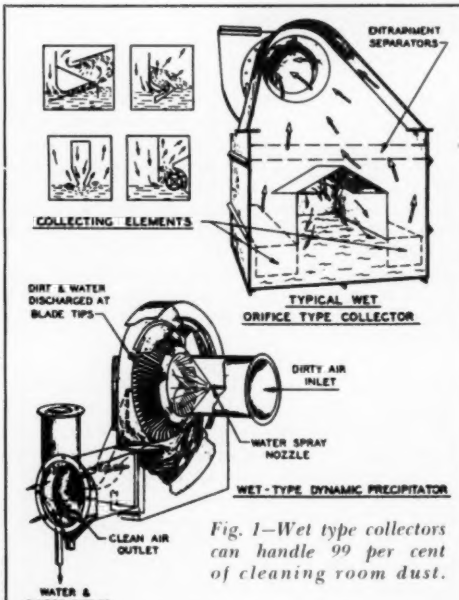


Fig. 1—Wet type collectors can handle 99 per cent of cleaning room dust.

John M. Kane, manager of the dust control division, American Air Filter Co., Louisville, has presented papers on industrial dust control before A.F.S. national conventions and engineering organizations, in addition to writing frequently for the technical press. He joined his present company in 1933 after his graduation from the University of Kentucky.

"air pollution" problem from smoke emission. Too often this visual standard is carried over to industrial applications without recognizing that its introduction was never intended to offer a means of detecting or evaluating solids concentration in a gas stream, but was offered as an indicator for proper combustion control which is the major factor in reducing the coal smoke caused by incomplete combustion of the fuel.

A review of existing regulations will indicate an attempt has been made to bodily apply standards designed for boiler fly ash and smoke control to the broader, immensely more complex control of industrial process emissions. Sometimes the 0.4 grain figure is reduced to 0.25 or 0.3. Allegheny County, in a new regulation which is still based on the boiler concept, has recognized and made exceptions for open hearth, by-products, coke plants, sintering plants, and Bessemer convertors, realizing the lack of similarity and wide range of conditions that are encountered in industry as opposed to the modest variations in conditions when only smoke and fly ash from coal burning gases of combustion are involved.

In fact, the problem of reducing air pollution is less difficult than the problem of establishing a regulation that will reduce industrial air pollution as far as possible and still stay within the performance range of present day equipment at reasonable cost and maintenance.

Control Attainable With Present Day Equipment

Dust Producing Operations: Foundry operations, other than melting and pouring, actually present no real dust control problem. The foundry industry as a whole has consistently purchased effective collection equipment for dust from shakeout, sand handling, abrasive cleaning, tumbling mills, swing frame, stand, and portable grinders.

Dust loadings from shakeouts will range from 0.25 to seldom more than 1.0 grain per cubic foot of exhaust air. Collection of some 95 per cent of such material is readily attainable with wet type collection equipment. Removal of 98 per cent or better is consistently attainable with such equipment exhausting the heavier 2 to 5 grains per cubic foot loads from shakeout, sand and core sand handling and conditioning equipment.

In the cleaning room, loadings from airless blasting and tumbling mills are very heavy, often reaching 15 to 20 grains during the peak of the removal cycle. Collection of 99 per cent or better is usual with good

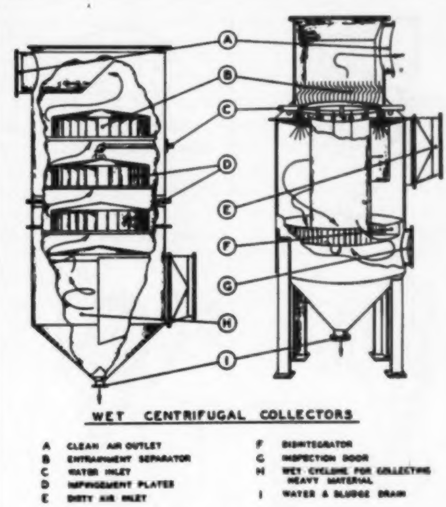


Fig. 2—A centrifugal type wet collector is often used with airless blast and tumbling machines.

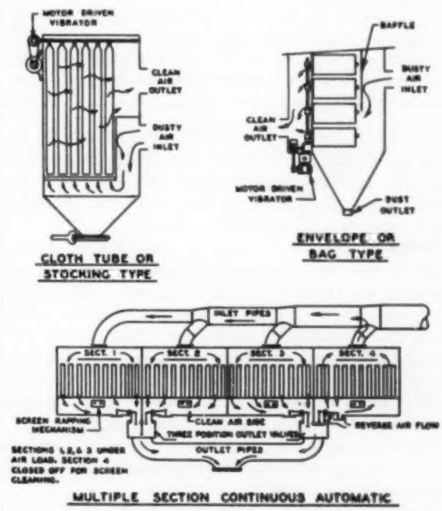


Fig. 3—Cloth types of dry arrestors are also in common use for collecting foundry dusts.

wet type (Figs. 1 and 2) or dry fabric type (Fig. 3) dust collectors.

Dust released by snagging, swing frame and portable grinding will seldom exceed 0.25 grains per cubic foot, with particle size appreciably coarser than the sand fines from the previous operation discussed. Dry centrifugal collectors (Fig. 4) are frequently used for this group, and collection efficiency in the 90-97 per cent range can be expected.

Based on the foregoing review, it is apparent that

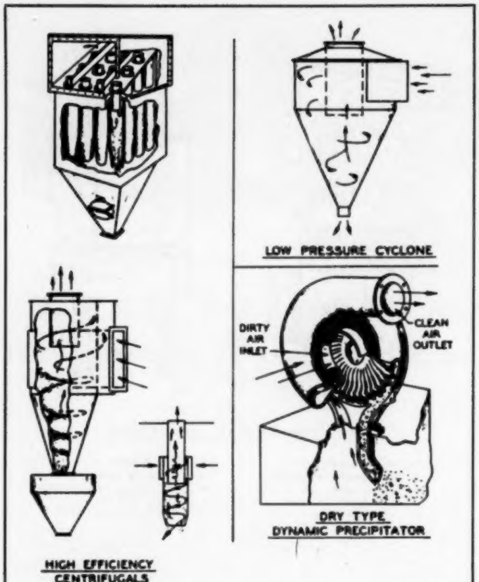


Fig. 4—Dry centrifugal collectors are frequently used with grinding operations. Figures 1 to 4 are from a publication of American Conference of Governmental Industrial Hygienists.

with present dry collection equipment effluent air from dust collectors on foundry shakeout, sand systems, abrasive cleaning, tumbling and snagging can be kept under 0.1 grains per cubic foot, with the effluent air practically free from visible escapement.

Melting: The air pollution and public nuisance problem in the foundry is mainly associated with the melting phase of foundry practice. An attempt to describe the problem from any melting furnace in terms of grains of solids per cubic foot of air is meaningless as the exhaust gases will be diluted to varying degrees, depending on the amount of room air that is used to control and exhaust the combustion gases and the released metal fumes and solids.

Non-Ferrous: In the non-ferrous foundry zinc oxide is the principal offender, concentrations being a function of the zinc content.

Zinc oxide is very fine, often in the 0.25 micron range. Temperatures of gases and presence of products of combustion make fabric collectors difficult to apply in spite of the high efficiencies obtainable with such designs. Particle sizes are so small that wet collectors do not provide effective cleaning even though they may remove from 60 to 80 per cent of the released oxide. Some success has been reported in the Los Angeles area with the use of fluxes to cover the exposed molten metal and retard the escapement of oxidized fumes from the melt.

Foundry Cupola: Dust loading from the foundry cupola will include iron oxide fumes and can include large quantities of coarse particles of coke, stone, and refuse blown from the charge by the air blast. Dust loadings from foundry cupolas have been reported as high as 2.5 per cent and as low as 0.3 per cent of the hourly melting rate. Coarser particles settle quickly from the cupola stack, introducing roof maintenance problems, and often a neighborhood public nuisance situation.

Fine metal fumes produce the red smoke that contributes to the air pollution problem of the area. Their particle size is approximately 0.5 microns. Wet collection equipment is indicated due to the gas temperatures, and degree of removal of the metal fumes will vary widely with the collector design.

Unless loadings and particle size distribution for a given cupola are known (such data are difficult to obtain as it involves elaborate sampling due to the uneven loading in the cupola stack gases), it becomes impossible to predict collector performance on a single efficiency figure basis. Performance will require efficiency of collection stated on a particle size basis or on an inefficiency figure in terms such as pounds of solids lost per ton of metal melted.

Cupola Emissions Vary Widely

This latter term may be practical if additional data confirm that the metal fume released per ton of metal melted is relatively constant. It seems logical that the quantities of coarse materials should vary widely from one cupola to another as they could easily change with charging methods, cupola loading and size. These coarser particles can be removed readily with available control equipment, and are not the portion that makes the cupola problem difficult.

The possibilities of the closed top, bell charged cupola, similar to blast furnace practice, becomes well worth consideration when collection equipment is involved as the reduced temperatures and gas volumes could mean drastic reduction in collector first cost and operating cost. The example shown in Fig. 5 illustrates the variations in collector requirements under closed and open top cupola charging methods.

The smokes contributing to air pollution during the starting-up cycle can be improved with cupola lighters which do eliminate the wood smoke. During melting, burning of gases in the heat exchanger of a hot-blast system or above the charging door may also improve discharge appearance and alter dust loadings by burning out combustible solids or gases in the cupola stack.

Ferrous Electric Melting Furnaces: Emissions from electric melting furnaces in the steel foundry have been investigated extensively and consist almost entirely of submicron particles of iron oxide, combustible refuse from the scrap melted, and portions of deteriorated refractory lining. Quantities will range from 4 to 8 lb per hour per ton of steel melted, and will be practically all less than 2 microns in particle size.

Good wet collection equipment can remove some 75 to 80 per cent of such solids, although discharge appearance will still be distinctly visible during the melt-down and the boiling portion of the refining cycle. On this application, the inability to specify air pollution control in terms of grains per cubic foot will be recognized.

From an air pollution point of view, regulations covering gas and solid emissions from foundry melting

furnaces will be difficult to compile. Existing collection equipment at reasonable cost and reasonable maintenance has so far demonstrated the following characteristics:

Non-Ferrous—Difficult to provide adequate public nuisance and air pollution correction. Dry fabric collection may be the answer where temperatures of exhaust gases are less than 200 F.

Gray Iron Cupola—Public nuisance fraction and a considerable portion of the fine air pollution fraction can be removed, but visible discharge must be expected. Cupola lighter and CO stack burners may aid in the over-all picture.

Electric Melting Furnace—Collection of 75 to 80 per cent of the metallic fumes is practical, although discharge of cleaned gases will still be visible.

Pouring: Smokes released during the pouring in most ferrous foundries have caused little or no trouble and their elimination appears far distant from an air pollution control viewpoint. The zinc oxides released in the pouring of some non-ferrous alloys will justify attention when cleaning equipment for such large volumes becomes economically feasible.

Reasonable Equipment Cost

In the discussion of types of cleaning equipment available for high temperature stack gas cleaning such as the cupola and the electric melting furnace, no mention has been made of equipment such as high voltage electro-static precipitation, sonic agglomeration, or fabric filters using glass or synthetic filtering media. While a greater degree of removal may be possible with some such equipment, cost appears far out of line for the improvement obtainable.

This statement seems especially significant when viewed against a background of what has been generally accepted as good practice and practical control in the fly ash problem from coal burning boilers. For such stacks, extreme reduction in fly ash emission could be obtained with, for example, the electro-static precipitator. Yet cost of such equipment for the usual industrial power plant would be certainly excessive and probably prohibitive. Recognition of this situation does explain the use of primary collectors on practically all stacks in this group except for the large central steam generating station in a congested area where the mass rate of fly ash emission necessitates and justifies the expense of electro-static collectors.

Consider Cost in Control Regulations

Cost is a factor in establishing reasonable yardsticks for air pollution control, yet it is difficult to suggest relative cost of equipment without specifying dust loadings including their physical and chemical characteristics, exhaust volumes, temperatures, gas composition, etc. Reasonable data are: Group 1—dry primary mechanical collectors, $0.15 to $0.20/cfm; group 2—high efficiency wet type or fabric collectors, $0.25 to $0.40/cfm; group 3—expensive controls for fine submicron sizes at elevated temperatures (equipment such as high voltage electro-static, ultra-sonic) $1.00 to $1.50/cfm.

The above figures would be equipment cost alone based on mid-1950 prices. They do not include erection, wiring, plumbing, foundations, or duct work. Prices in group 3 would be sustantially higher for volumes less than 25,000 cfm due to the high fixed cost of electrical conversion or sound wave generators.

Conclusions

1. For dust producing operations such as shakeout, sand conditioning, abrasive blasting, tumbling, swing frame, snag, and portable grinding, present day collection equipment in general foundry use can keep escaping concentrations to less than 0.1 grain per cubic foot. Processes in this group equipped with air cleaning equipment of the proper type and in good repair, should cause no problems in air pollution control work.

2. Cupolas and electric melting furnaces for melting ferrous metals can be equipped with collection equipment that can reduce solids escapement to the order of 4 to 8 lb per hour per ton of metal melted.

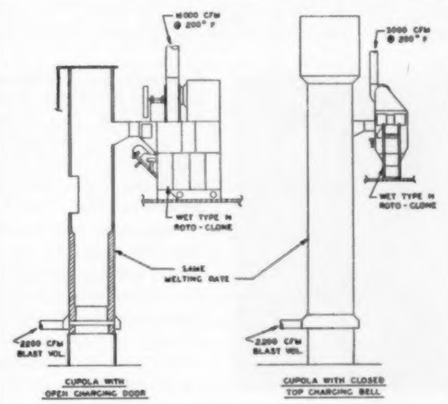


Fig. 5—Collector requirements for open and closed top cupolas vary widely in size and cost.

Escaping metal fumes in such quantities will still present a visible discharge appearance.

3. Extension of "fly ash and smoke abatement" codes developed for coal burning gases of combustion to industrial processes will be complicated because:

(a) No regulation will be effective that does not have sound engineering for its background, or whose requirements exceed those attainable by existing equipment at reasonable cost and reasonable maintenance.

(b) Standards of required air cleanliness measured in unit of weight per unit of gas volume will be meaningless for those applications where extensive dilution by added room or outside air to the exhausted contaminant is practical.

(c) Visual methods of determining solids concentration in stack gas are futile except as a crude gage to indicate discharge conditions that *might* be in violation of a standard based on a permissible weight basis.

(d) Stack sampling procedures are expensive and time consuming, involving added cost to industry whether such data is obtained by the plant, a con-

sulting engineer, an equipment manufacturer, or a governmental agency.

References

1. A. J. Grindle, "Prevention of Smoke, Fumes, and Solids From Cupola Operations," Smoke Prevention Society, *Transactions*, 1949.
2. J. M. Kane and R. V. Sloan, "Fume Control—Electric Melting Furnaces," American Foundryman, Nov. 1950, p. 33.

AIR POLLUTION AND PUBLIC HEALTH

Kenneth E. Robinson

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The foundry is a good place to work! This can be a true statement providing the industry as a whole is willing to accept the fact that there are health problems in the operation of a foundry, and to accept the responsibility of doing something about them.

Factors such as noise and lighting are often forgotten when health problems are discussed. There is little doubt that many of the complaints received by management are due to the effects of excessive noise, poor lighting, and generally undesirable conditions.

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The old, well-known hazards are, of course, still with us. A potential hazard may be found anywhere materials containing high percentages of free silica are used. Operations usually involving the use of free silica are the core room, sand preparation, molding, sandslinger, shakeout, cleaning, sand blasting and relining of cupolas.

Hazards less well known, but still of importance, include dermatitis, particularly from certain core sand mixtures, and carbon monoxide given off from the skin drying of large molds, during the pouring of metal and at other places where incomplete combustion may occur. At times hazards not ordinarily connected with the foundry industry are found, such as lead in paint, carbon tetrachloride in repair shops and other chemicals used in special operations.

This article will deal mainly with the potential hazards created by the discharge of material to the surrounding atmosphere. Whenever a material is controlled by ventilation, the air should be thoroughly cleaned before being exhausted. This is a matter which has been neglected considerably by industry until today there is an ever-increasing outcry against industry and its pollutants. For example, a breakdown of the materials discharged from one cupola reported in the literature showed an average of 50 lb of particulate matter per hour, with 37 lb collected and 13 lb carried through. Of this material, 95 per cent was less than 44 microns in size, with a large percentage below 10 microns. A micron is 1/25,000 of an inch, and it is believed that particles larger than 10 microns do not cause injury to the body.

Table 1 shows that all of the materials exhausted from the cupola exceeded the maximum allowable concentration. The maximum allowable concentration is that limit which has been set up by the American Conference of Governmental Industrial Hygienists as a safe concentration for an 8-hr per day exposure. These limits are based on experimental work on animals and field experience. One must remember that the average worker is in better physical condition than many citizens that might live near an industrial plant.

Effluents Contain Several Materials

Another factor which makes the evaluation of stack effluent difficult is that the maximum allowable concentration limits are set up on the basis of a worker being exposed to one contaminant only. The medical profession is not yet ready to make definite statements as to what will or can happen to people in various states of health when subjected to even minute quantities of a number of materials 24 hr a day.

There was a time when people took great pride in seeing quantities of smoke coming out of industrial stacks. It meant to them that the mill or plant was in high production and, therefore, work was plentiful for those living nearby. Today that is not necessarily true. In fact, with the advent of the automobile and rapid transportation, people are more apt to work at some plant further from home and to complain bitterly if the nearby plant gives off objectionable fumes, odors or solid materials.

Without question there are many people who are made more uncomfortable and complain more because of odors which supposedly have no health significance than are exposed to harmful concentrations of toxic materials. There is an increasing demand for the elimination of air pollution and industry must recognize the problem and do its utmost to eliminate it.

The possibility of legislative action on the problem

Table 1—Cupola Stack Emissions

Material	Max. Allowable Concentration		Through Cupola	Above Max. Allowable Concentration
Silica	20	MPPCF*	134 MPPCF	6.7
Lead	0.15	Mg/M³**	1,528,450 Mgs	2473
Zinc	15	Mg/M³	555,000 Mgs	8.9
Iron	15	Mg/M³	1,990,000 Mgs	32
Magnesium Oxide	15	Mg/M³	618,435 Mgs	9.9
Manganese	15	Mg/M³	735,000 Mgs	11.8
Phosphorus	0.1	Mg/M³	11,300 Mgs	27.2
Sulphur	10	PPM†	1,349,600 Mgs	12
Nuisance Dust	50	MPPCF	10,400,000 Mgs	7

* Million particles per cubic foot of air.

** Milligrams per cubic meter.

†Parts per million parts of air.

must be faced. The amount of legislation will depend greatly on industry. Health authorities prefer to cooperate with industry on this problem rather than resort to mandatory procedures. If the foundry industry faces this problem squarely, there is no reason why air pollution cannot be successfully eliminated.

AIR POLLUTION LEGAL ASPECTS

Thaddeus Giszczak

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ALTHOUGH SOME SMOKE ORDINANCES date back to about 1920, metallurgical equipment was usually "exempted in toto." Ordinances enacted about 1947 began to specify dust and fly ash loadings emitted by a stack and generally refer to any furnace, manufacturing equipment or machine. Law enforcement groups, inspection groups, etc., were organized under these ordinances but since the field of air pollution was relatively new—and the public had to be educated to the purposes of the ordinances—no immediate enforcement was attempted. Enforcement groups have since carefully analyzed the ordinances.

Several incidents have occurred which have aroused public interest. In the Donora, Pa., incident, for example, the surgeon general released a report of the work done by engineers, chemists, physicians, dentists, nurses, and the Weather Bureau. This investigation took the full time of 25 Public Health Service experts in industrial hygiene for one year. Commenting at a news conference with Surgeon General Leonard A. Scheele, Oscar R. Ewing, federal security administrator, called for immediate attention to the long range problem of air pollution. He stated that federal, state, and local agencies must cooperate with industry on air pollution control in each industrial city and town, and that the problem is of major importance. Studies are now under way which will attempt to determine the extent to which the health of people living in such communities is affected by air contamination.

Residential and Rural Districts

Cupolas operated in or near residential areas constitute a problem to the neighbors. In one case the burning of front porch steps and the pitting of paint on cars and homes can be traced to hot coke particles issued by a cupola. The people in this area have long known that to have a wood shingle roof was to invite a fire. The women hang out their wash on days when the foundry is idle. On damp, foggy days, when the smoke flows along the ground, there have been complaints of bad odors, etc.

Industry located in rural areas does not escape the problem because various farmer's organizations have acted to prevent them from emitting anything that will damage crops or mar the landscape.

An examination of some of the ordinances enacted reveals that they are not uniform as to the quantity of material that may be emitted by a stack. Neither are they uniform with respect to permissible smoke densities during light-up periods, or the time allotted for light-ups. In some instances stack emission material limits have not been specified. Under such circumstances the quantity of emission becomes a matter of judgment on the part of the smoke abatement officer.

Thaddeus Giszczak, *arranger and coordinator of the air pollution panel discussion at the 1950 Michigan Foundry Conference, is a 1938 graduate of Wayne University, Detroit. From 1947 to 1950 he was research metallurgist for the A.F.S. Cupola Research Committee, and is now metallurgist for Central Foundry Division of G.M.C., Saginaw, Mich.*

When quantities of emission are specified the variation is found to be from 0.30 to 0.75 grains per cubic foot of stack gas. These limits for stack emission are adjusted on the basis of permissible excess air during testing or an adjustment for carbon dioxide.

In some ordinances a weight limit is stated for 1000 lb of gas adjusted to a 12 per cent carbon dioxide concentration. Others state that 15 per cent of the amount entering a collector may be emitted. The Los Angeles ordinance states the amount of emission in terms of throughout, and specifies a limit of 40 lb for a throughput of 60,000 lb.

Basis for Density Definitions

Most ordinances define the permissible density of smoke during the light-up period in terms of Ringelmann Chart* numbers and state the time allotted for them. Various methods are used to express this. For instance, the Baltimore ordinance states that smoke of a density of No. 2 or less on the Ringelmann Chart shall be permitted for a total of 9 min or less during an hour or No. 2 or more for 6 min or less during the hour. The Detroit ordinance states that smoke of a density of No. 2 or less shall be permitted for 4 min in 30 min or No. 3 or less for 3 min in 15 min.

The times written into these ordinances do not coincide with any metallurgical operations. Since they differ widely in the manner of statement it would be best for each foundryman to get a copy of the ordinance that pertains to his locality. It would also be desirable to get the inspector's interpretation of this section of the ordinance inasmuch as the section on smoke density was originally intended to apply to boiler installations.

Although various references have been made to permissible amounts of emission, no reference has been made to any data obtained from cupola operation because no accurate measurements have been made to determine the actual amounts of emission under various conditions. According to data available at present a cupola lined to 60 in., melting about 15 tons per hr, will issue about 30 lb of dust per ton. More measurements are being made as a background for the revision of ordinances. These, however, will take considerable time as instrumentation and methods, although worked

**Ringelmann Smoke Chart or Scale of Smoke Densities,* Information Circular 6888, U.S. Bureau of Mines, Department of Interior, June, 1945.

out for boilers, have to be altered for cupola testing.

Although data are not available to engineer a perfect dust suppressor, cupola operators can do several things to decrease the material emitted from their cupolas. Effluent gas volume is approximately 1½ times the incoming air volume. Thus, the gases pass the charging door with considerable velocity. Materials are charged countercurrent to this flow. Hence, fines are buoyed upward by the effluent gases, passing up the stack to collect on the foundry roof. If the wind is sufficiently strong and in the right direction, particles emitted go beyond the foundry property where they are usually termed a nuisance.

Velocities are greater at the time of charging, since the charging bucket constricts the cupola. Returns with loose sand, scrap with dirt and loose corrosion products, coke with fines, weathered limestone, and poorly compacted briquets dropped into the cupola cause a disturbance of the fine materials allowing them to be carried away by the effluent gases. Thus, the emission can be made up of several elements together with small amounts of sulphur dioxide from coke and carbon monoxide from incomplete combustion.

Starting New Fires

Cupola light-up is an important factor in operating procedures. Oil and wood light-ups are regarded in some communities as violations of the smoke ordinances. Both create a concentration of smoke due to volatile matter content that is beyond the specified maximum allowance. To avoid this difficulty several cupola operators are using electric igniters. Coke fines are used with the electric igniter (AMERICAN FOUNDRYMAN, August, 1949, page 48) and since the volatile matter present is comparatively low there is little smoking.

Various techniques for decreasing emitted material in the effluent gases can be used with or without suppressors. First, anything that can be done to decrease dusting at the charging door is a step in the right direction. Removal of coke fines is imperative. If screening is not possible chutes can usually be arranged at an angle. Holes in the bottom plate permit fines to drop through as the coke comes down from the hopper. This arrangement is not the best but it will help a great deal. Coke charged by hand should be handled with forks having tines at least 3 in. apart.

Charging buckets discharging with impact break coke into smaller pieces, creating fines that are carried away by the effluent gases. At the same time, the impact disturbs all the fine materials that come in with the metal charge. Intermediate coke charges during normal periods should be made as soon as the melting stock is one charge down to avoid an excessive drop.

Check Sand Quantities

Although it is desirable to charge a certain quantity of sand to obtain good slag fluidity, sand carried out by effluent gases is of no value. Since a slag balance can be reached with lesser quantities of both sand and limestone, it is good practice to separate loose sand from the returns before placing them in the charging buckets. Separation can be done magnetically or by dropping returns onto a set of inclined bars. A container under the bars catches the down-coming sand.

Some foundries use large quantities of steel and cast iron briquets. In a number of operations these are compacted without removing the cutting oil from the chips. Cutting oils, although possessing a high volatilization temperature, will distill off in the upper part of the cupola stack. This has a tendency to disintegrate the briquets and block the smooth flow of cupola gases. Operators using water curtain dust suppressors find that the cutting oil vapors pass through the curtain.

Some of the material emitted is combustible and part of it is burned at or above the charging door. The amount burned is dependent upon the carbon monoxide content of the effluent gases, higher carbon monoxide contents giving higher flame temperatures in the stack. If sufficient air is present some of the combustibles, such as coke breeze and the distilled cutting oil, can be burned, lessening the amount of material emitted. However, precautions must be taken to insure continuous burning. Sudden gusts of wind through the charging doors cause turbulence which may put out the flames. Burners placed above the charging doors are recommended to insure continuous combustion.

These suggestions do not exhaust the list. Each cupola operator will have to examine and study his individual problem. Many smoke abatement officers believe that each case must be considered on the basis of location of the source and with reference to the surrounding area. They do not want to be more specific until they have obtained more experience on which to base more definite requirements. They are approaching the problem cautiously.

It is desirable that foundrymen work with smoke abatement officers and groups so that information compiled will be technically correct. The nature of the rewritten ordinances will to a great extent depend upon the information that they have at hand. As a matter of fact the design and operation of the cupola may be determined by the decisions made by the cooperating groups.

Future Meetings and Exhibits

BIRMINGHAM REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Birmingham District Chapter, Tutwiler Hotel, Birmingham, Ala., Feb. 22-23.

AMERICAN SOCIETY FOR TESTING MATERIALS, committee week, Netherland Plaza Hotel, Cincinnati, Mar. 5-9.

OHIO REGIONAL FOUNDRY CONFERENCE, sponsored by A.F.S. Northeastern Ohio, Cincinnati District, Toledo, Canton District, Central Ohio, and Ohio State University Student Chapters, at Case Institute of Technology, Cleveland, Mar. 9-10.

WESTERN METAL CONGRESS AND EXPOSITION, Civic Auditorium, Oakland, Calif., Mar. 19-23.

55th Annual Foundry Congress, American Foundrymen's Society, Buffalo, N. Y., Apr. 23-26.

AMERICAN SOCIETY FOR QUALITY CONTROL, annual convention, Hotel Cleveland, Cleveland, May 23-24.

FRENCH FOUNDRY ASSOCIATION, foundry congress, Paris, France, June 4-6.

INSTITUTE OF BRITISH FOUNDRYMEN, foundry congress, Newcastle-on-Tyne, England, June 12-15.

AMERICAN SOCIETY FOR TESTING MATERIALS, annual meeting, Chalfonte-Haddon Hotel, Atlantic City, N. J., June 18-22.

MALLEABLE FOUNDERS' SOCIETY, annual meeting, the Homestead, Hot Springs, Va., June 21-22.

INTERNATIONAL FOUNDRY CONGRESS, Brussels, Belgium, Sept. 10-14.

ELIMINATE SECOND INOCULATION IN NEW NODULAR IRON PROCESS

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PRODUCTION OF MAGNESIUM-TREATED nodular iron involves a double treatment. An addition of magnesium in excess of the quantity that reacts with oxygen, sulphur, . . . (and consequently is eliminated by precipitation of MgO, MgS, . . .) must be made in order to obtain a sufficient amount of residual magnesium. Solidification of this iron results in a white or mottled structure. In order to obtain a gray nodular iron it is necessary to apply a second treatment, the so-called secondary inoculation or graphitizing treatment, consisting of an addition of 0.3 per cent or more of ferrosilicon or other silicon alloy.

In the case of calcium-treated nodular iron it does not seem necessary, except perhaps for pouring very thin sections, to apply a secondary inoculation. Indeed, as-cast ½-in. round bars of calcium-treated nodular iron without secondary inoculation do not show any free carbide; on the contrary, fairly large amounts of ferrite surrounding the spherulites and the compact graphite are visible in the matrix (Figs. 1 and 2).

The use of calcium for the purpose of compacting the graphite in gray cast iron is not new. Some 25 years ago A. F. Meehan and O. Smalley[1] reported remarkable mechanical properties of calcium- and calcium-magnesium-treated irons, such properties mainly resulting from compacting the graphite.

Produce Graphite Spherulites With Calcium

We know that the compacting effect on the graphite is associated with the presence of strongly deoxidizing and desulphurizing elements such as Ce, Mg, Li, Ca, Sr, Ba, Na, K, etc. The compacting effect is gradual, resulting finally, when the residual amount of one or more of the above mentioned elements is sufficient, in the so-called nodular structure with the greater proportion of the graphite as well-formed spherulites.

The production of graphite spherulites in cast iron by calcium addition to a low-sulphur iron was first reported more than 2 years ago,[2] and was confirmed by the same author[3] and others. The first experiments were carried on with calcium silicide as the addition alloy, and the use of iron with too high sulphur content gave rather poor results although some spherulites were obtained in those sections corresponding to a certain favorable critical cooling. Further experiments with a 70-30 copper-calcium alloy gave better results, but such an alloy is not stable and must be prepared shortly before use.

As previously pointed out,[3] it is desirable to make use of carriers in order to introduce in cast iron small amounts of magnesium, calcium, or lithium. Good carriers are those elements which are readily soluble in cast iron without harmful effects, and which form alloys with the nodulizing element; there are only a few, silicon, copper, and nickel being the best.

As the unstable 70-30 copper-calcium alloy gave promising results, it was decided to try ternary and quaternary alloys of the calcium-silicide base obtained by alloying it with either copper or nickel or both. This reduced considerably the amount of calcium per unit of alloy, but the recovery was much better.

Several alloys belonging to the composition range calcium, 10-40 per cent, silicon, 30-80, copper, 0-40, nickel, 0-30 were tried, especially the alloys C_1, C_2, and C_3 shown in Table 1.

The results obtained with a 4 per cent addition of alloy C_1 are shown in Fig. 1. Such an amount of nodulizing alloy is extremely high and, as the base iron was very low in sulphur (0.017 per cent), it is obvious that the process is of very limited practical interest. Similar results were obtained with a 3 per cent addition (Fig. 2), and even with less, but in the latter case reproducibility was poor. It is likely that the calcium process may be improved either by improving the nodulizing alloys or the method of addition, but it

TABLE 1—CALCIUM ADDITION ALLOYS

	Composition, %			
Alloy	Ca	Si	Cu	Ni
C_1	24	56	20	—
C_2	26	59	—	15
C_3	20	46	20	14

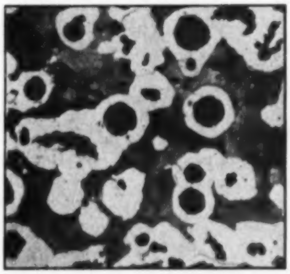


Fig. 1—Nodular iron treated with 4% calcium alloy C_1 (Table 1). Initial S, 0.017%; final S, 0.012%. Tensile strength, 77,400 psi; elongation, 5.7% as cast. X200.

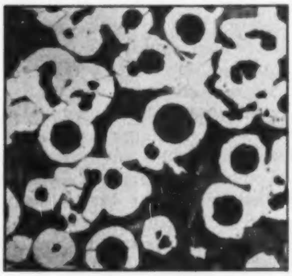


Fig. 2—Calcium treated nodular iron—3% calcium alloy C_1 (Table 1). Percentage composition—C, 3.58; Si, 1.84; Mn, 0.02; P, 0.01; S, 0.010; Ca, present. Tensile strength, 59,700 psi. Elongation, 4% as cast. X200.

NOTE: This paper is based on nodular cast iron research sponsored in Belgium by IRSIA (National Institute for Scientific Research Applied to Industry and Agriculture), and Fabrimetal (Federation of Industrial Enterprises for Metal Fabrication).

Fig. 3—Compacted graphite iron treated with 0.5% Ca-Mg alloy CM_3 (Table 2). Final S, 0.012%; Mg, 0.003; Ca, distinctly present. Tensile strength, 24,200 psi. Elongation, zero. X200.

Fig. 4—Ca-Mg treated nodular iron—1% alloy CM_3 (Table 2). Final S, 0.011%; Mg, 0.005; Ca, distinctly present. Tensile strength, 55,500 psi. Elongation, 1.1%. X200.

appears it will be of interest only for the nodulizing treatment of very low sulphur irons.

Previous experiments in the production of nodular iron with Mg, Ca, Li, Ba, Sr, Na, and K indicated that magnesium and lithium were the strongest carbide stabilizers; this is well known in the case of magnesium, where the stabilizing effect results in a white structure (unless secondary inoculation is applied) as soon as the residual magnesium becomes sufficient to guarantee the spheroidal shape of the graphite.

Comparing the nodulizing capacity of the above elements, sodium and potassium seem to be the poorest and, moreover, their alloying possibilities are also very poor; the latter shortcoming applies equally for the very expensive elements barium and strontium, and to a lesser extent for lithium. The objection may be made that lithium also is an expensive element, but it should not be forgotten that lithium is abundantly distributed in the earth's crust and that it could be produced at a relatively low cost if there were a sufficiently large application for it.

As a result of those considerations, although a great many combinations were rapidly tried, a more detailed investigation was made of the combined effect of Ca-Mg-Li. Although this study is still under way and far from finished, some results will be presented here.

Combined Ca-Mg and Ca-Li Nodulizing Treatment Without Secondary Inoculation: It has been pointed out that the calcium treatment is capable of producing gray nodular iron without secondary inoculation; however, in order to obtain consistent results it seems necessary to start with a very low sulphur iron, for example 0.02 per cent, and even then a 3 per cent calcium addition is necessary.

In applying to the same very low sulphur iron the combined Ca-Mg treatment by using a similar alloy in which some 2 or 3 per cent magnesium was incorporated, similar results were obtained with 1 or 2 per cent alloy addition instead of 3 or 4 per cent in the case of the straight calcium treatment. Such low additions as 1 or 2 per cent of an alloy, itself containing only 2 or 3 per cent magnesium, result in a residual magnesium content in the cast iron of about 0.01 per cent, which seems to have no carbide stabilizing effect.

However, if richer magnesium alloys are utilized, and if the amount of the addition is such that a residual magnesium content in excess of 0.02 per cent is obtained, the character of the nodular iron is changed and, in order to obtain a gray cast iron, secondary inoculation with silicon is again necessary.

Combined Treatment Advantages

From the foregoing considerations it appears that the advantages of the combined Ca-Mg treatment applied to a very low sulphur iron are:

(1) over straight calcium treatment; (a) only 1 or 2 per cent alloy addition instead of 3 or 4 per cent, and thus less cooling effect on the iron; (b) economical advantage of smaller additions, the price of the alloys being practically the same.

(2) over straight magnesium treatment; (a) no secondary inoculation; (b) no violent reaction nor fumes; (c) cheaper addition alloys.

It should be remembered that above mentioned advantages over the straight magnesium treatment apply only to the low sulphur irons, and that the graphite is not so perfectly spheroidal and consequently tensile strengths are somewhat lower. We feel however

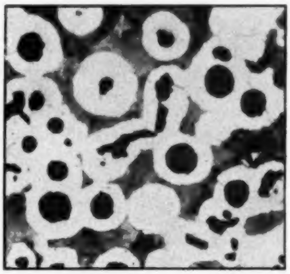


Fig. 5—Nodular iron treated with 2% Ca-Mg alloy CM_3 (Table 2). Final S, 0.012%; Mg, 0.010; Ca, distinctly present. Tensile strength, 69,700 psi. Elongation, 10%. X200.

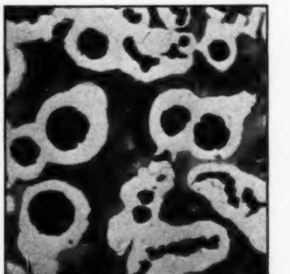


Fig. 6—Ca-Mg treated nodular iron—2% alloy CM_3 (Table 2) with 0.8% Mn added before Ca-Mg treatment. Final S, 0.011%; Mg, 0.014; Ca, distinctly present. Tensile strength, 75,400 psi. Elongation, 1.4% X200.

Table 2—Calcium-Magnesium Addition Alloys

	Composition, %				
Alloy	Ca	Si	Mg	Cu	Ni
CM_1	33	64	3	—	—
CM_2	24	54	2	20	—
CM_3	24	54	2	—	20
CM_4	26	57	2.5	—	14.5
CM_5	22	51	2	15	10
CM_6	26	57	2	15	—

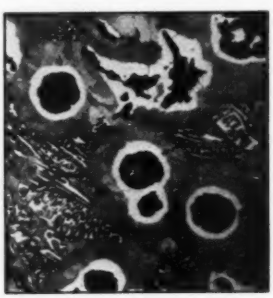
that the very high strengths are not necessary for many applications, and we wish to postpone conclusions with regard to the comparison of the mechanical properties of Ca-Mg- and Mg-treated irons to a time when results of a more detailed investigation, now under way, are available.

It should be mentioned that the experiments on which this paper is based were carried on for the purpose of structure study only; consequently, most of them were from 1-lb melts from which ½-in. round sand bars were poured. Small test specimens machined from these bars were not always sound but were tested anyway to get a rough idea of the possibilities of this and other combined treatments.

Of the addition alloys for the combined Ca-Mg treatment, the best results were obtained with complex alloys prepared with a calcium-silicide base to which small amounts of magnesium were added, together with at least one of the good heavy carriers—copper and nickel. According to our present knowledge we would suggest the following composition limits: Ca, 20-35 per cent; Si, 40-65; Mg, 1-5; Cu, 0-40; Ni, 0-30. Most of our experiments with Ca-Mg alloys belonging to this series were carried on with the alloys CM_1 to CM_6, the approximate compositions of which are given in Table 2.

As a first general conclusion from our experiments with the alloys shown in Table 2, no great difference

Fig. 8—Ca-Mg treated nodular iron—2% alloy CM_3 (Table 2) with 1.0% Mn added before Ca-Mg treatment. Final S, 0.012%; Mg, 0.012; Ca, distinctly present. Tensile strength, 72,800 psi. Elongation, 6.8%. X200.



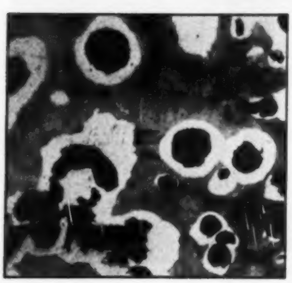
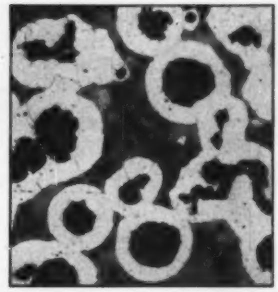


Fig. 7—Nodular iron with 0.70% Mn added before treatment with 2% Ca-Mg alloy CM_3 (Table 2). Final S, 0.011%; Mg, 0.009; Ca, distinctly present. Tensile strength, 62,600 psi. Elongation, 2.0%. X200.

Fig. 10 — Ca-Mg-Li treated nodular iron —2% alloy CML_1 (Table 4) as cast without secondary inoculation. Percentage composition (except Ni): C, 3.94; Si, 2.20; Mn and P, <0.02; S, 0.013; Mg, 0.010; Ca and Li, present. T.S., 59,700 psi. El., 4.2%. X200.



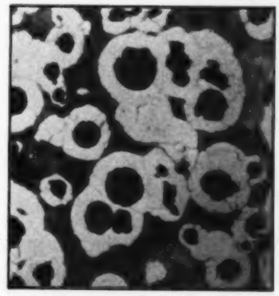


Fig. 9—Addition alloy CL_4 (Table 3) was used for 2% Ca-Li treatment to produce nodular iron similar to that of the Ca-Mg treatment. Final S, 0.011%; Mg, 0.00; Ca and Li, distinctly present. T.S., 58,300 psi. El., 4.1%. X200.

in effects is apparent. As a matter of fact they are all relatively similar because they all contain nearly the same amounts of calcium and magnesium, and nearly the same amounts of the heavy carriers copper and nickel. It is believed that the possibilities of the combined Ca-Mg process may be judged fairly well from the results of two series of experiments with alloy CM_3.

In the first series increasing amounts of alloy CM_3 were added to a very low sulphur iron (0.015-0.020, average 0.017 per cent) containing practically no manganese and no phosphorus. The results obtained are illustrated by Figs. 3, 4 and 5.

In the second series a constant amount of 2 per cent of alloy CM_3 was added to the same very low sulphur base iron to which increasing amounts of manganese were added before the Ca-Mg treatment. The results are shown in Figs. 6, 7 and 8.

Mechanical properties reported are rather irregular, but the poor experimental conditions of pouring the small quantity of metal are at least partially responsible. The results obtained must be considered as giving only a rough indication, and no conclusions should be drawn until the results of more precise experiments now under way are available. It should also be noted that, although most of the melts were of hyper-eutectic irons, some were hypo-eutectic, and in the latter case it did not seem more difficult to obtain the nodular structure.

The Ca-Li treatment, applied to the same very low sulphur irons with similar addition alloys in which magnesium is replaced by a somewhat larger lithium content, gave similar results. The larger amount of lithium is desirable since, although more effective with regard to the production of graphite spherulites than calcium, it does not seem as effective as magnesium. On the other hand, the carbide stabilizing effect of

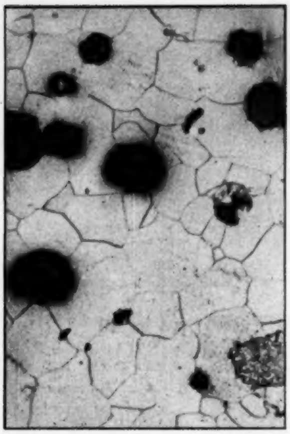
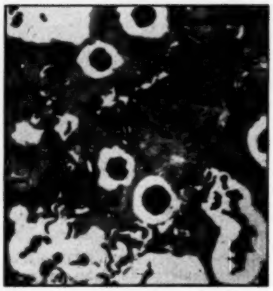


Fig. 11—Ca-Mg-Li treated nodular iron, same as Fig. 10, after incomplete annealing. Tensile strength, 55,500 psi. Elongation, 17%. X200.

Fig. 12—Ca-Mg-Li treated compacted graphite iron—2% alloy CML_2 (Table 4). Initial S, 0.033%. Final composition (except for Cu)—C, 3.40%; Si, 2.46; Mn, 0.29; P, 0.07; S, 0.022; Mg, 0.011; Ca and Li, distinctly present T. S., 46,900 psi. El., 0.6%. X200.



lithium appears also to be less than that of magnesium, so that larger amounts of lithium may be added and still not produce white iron when secondary inoculation is omitted.

Most of the experiments along the line of the Ca-Li treatment were carried on with the addition alloys CL_1 to CL_4, the compositions of which are shown in Table 3. As the results are very similar to those of the combined Ca-Mg treatment only one example (Fig. 9) is shown.

So far no method has been developed for quantitative determinations of calcium and lithium; spectrographic analysis of calcium or Ca-Li treated irons indicates very distinctly the presence of these elements in the nodular casting obtained. It is believed that the residual amounts of calcium or calcium and lithium are in close relation with (if not entirely responsible for) the compact or fairly good spheroidal structure of the graphite, and it therefore appears desirable that a method of quantitative analysis of small amounts of calcium and lithium in cast iron should be developed.

Combined Ca-Mg-Li Nodulizing Treatment With or Without Secondary Inoculation: Several Ca-Mg-Li alloys on a calcium-silicide base and with at least one of the good heavy carriers, copper and nickel, were prepared for experiments with a very low sulphur iron (0.020 per cent), and with a slightly higher sulphur iron (0.030-0.050 per cent). Approximative compositions of the most used alloys are shown in Table 4.

TABLE 3—CALCIUM-LITHIUM ADDITION ALLOYS

	Composition, %				
Alloy	Ca	Si	Li	Cu	Ni
CL_1	22	50	5	23	—
CL_2	24	53	5	—	18
CL_3	20	46	4	15	15
CL_4	21	49	10	20	—

For the treatment of very low sulphur iron a 1 per cent addition of those alloys generally was sufficient and gave a gray nodular iron without secondary inoculation provided, of course, that the silicon content was not too low.

In some cases 2 per cent additions of alloy CML_1 were made without following secondary inoculation, and even then gray nodular iron was obtained in the ½-in. round bar. Such a result is shown in Fig. 10, while Fig. 11 shows the structure of the same nodular iron after ferritizing annealing. In the latter case an elongation of 17 per cent was obtained, although the pearlite constituent was not entirely decomposed during the annealing cycle.

Although those alloys may be utilized for the treatment of the very low sulphur irons (0.02 per cent), they were especially prepared for experiments on iron melts with somewhat higher but still relatively low sulphur content (0.030-0.050 per cent).

Experiments on a larger scale this time (10-15-lb melts) with a base iron of composition C, 3.40 per

TABLE 4—CA-MG-LI ADDITION ALLOYS

	Composition, %					
Alloy	Ca	Si	Li	Mg	Cu	Ni
CML_1	20	48	10	2	—	20
CML_2	20	48	10	2	20	—
CML_3	18	40	15	2	12	13
CML_4	22	51	6	3	18	—
CML_5	20	48	15	4	13	—

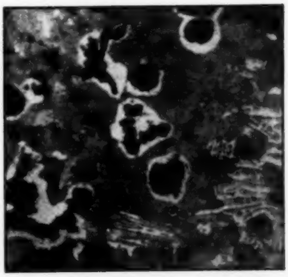
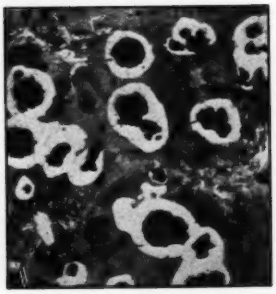


Fig. 13—Ca-Mg-Li treated nodular iron—3% alloy CML_2 (Table 4). Same as Fig. 14 but without secondary inoculation. X200.

Fig. 14—Ca-Mg-Li treated nodular iron —3% alloy CML_2 (Table 4). Secondary inoculation, 0.5% Si. Initial S, 0.033%. Final composition (except for Cu)—C, 3.16%; Si, 2.50; Mn, 0.21; P, 0.07; S, 0.016; Mg, 0.019; Ca and Li, present T. S., 74,000 psi. El., 2.2%. X200.



cent, Si, 0.90 (Si was added eventually in order to obtain final Si of 2.5 per cent), Mn, 0.30, P, 0.07, S, 0.033, led to the conclusion that a 2 per cent addition of alloy CML_2 was the lower limit giving sometimes a fairly good nodular iron. However, in most cases the result was compacted graphite and some well formed spherulites (Fig. 12).

Although such a structure does not correspond to a real nodular iron (the term "compacted graphite structure" describes it very well) there is at least what might be called a nodular character, and there are indications that such a structure is very desirable for certain applications.

A 3 per cent addition of the same alloy to the same base iron gave very consistently the desired nodular graphite structure. However, in that case the ½-in. round bar is mottled or white unless secondary inoculation is applied Figs. 13 and 14).

The results related in this paper are those of a series of first experiments, most of them carried on with small quantities of synthetic iron. It is likely that better results may be obtained, but it is also likely that the processes described will give good results only with low (0.03-0.05 per cent) and very low (0.02 per cent) sulphur irons. With the basic cupola those processes may have practical interest.

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2. A. L. De Sy, "Inoculation et graphite des fontes grises," presented at the Foundry Congress in Paris, Oct. 9, 1948, published in *Fonderie*, Jan. 1949.
3. A. L. De Sy, "Quelques resultats de recherches Belges sur les fontes nodulaires," Preprint No. 20, International Foundry Congress in Amsterdam, Aug.-Sept. 1949; and "Further Results of Belgian Nodular Cast Iron Research," AMERICAN FOUNDRYMAN, May, 1950, p. 75.
4. A. L. De Sy, "La Contribution Belge dans l'etude des fontes nodulaires," *Revue Universelle des Mines et de la Metallurgie*, Aug. 1950.

VOLUNTARY PROTECTION OF TECHNICAL INFORMATION

HARMFUL RELEASE of technical information not subject to formal security restrictions can be prevented through a voluntary program recently established to help the public guard against releasing strategic information. The Office of Technical Services of the United States Department of Commerce will answer requests for advice as to whether data should be disclosed, withheld, or given limited distribution.

Industrialists, businessmen, scientists, public officials and private citizens are invited to use this service whenever a question arises as to whether technical information should be disclosed. It is up to the individual whether or not he acts on the Government's advice. There is no compulsion; the program is entirely voluntary.

Requests for advice concerning release of technical information, together with pertinent manuscripts, plans, or documents, if they are available, should be addressed to: Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. Enclosures will be returned with the Government's comment. Instantaneous service cannot be provided, but all inquiries will be answered promptly within the limitations imposed by problems of fact and judgment.

All major powers depend on published data for a great share of their strategic intelligence. The present state of emergency has directed attention to the security implications of imprudent release of technical information. This program of voluntary protection is directed toward technical information which, if disclosed, would weaken the total position of the United States more than strengthen it.

The Government is fully aware of the dilemma presented by any limitation, even though voluntary, on the flow of information among private citizens and recognizes that free exchange of information contributes to rapid progress in science and industry.

The program is not primarily concerned with information which is "classified," unauthorized disclosure of which is forbidden under penalty of law. If a question exists whether certain information is classified, however, this OTS service is available to obtain specific advice.

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In conducting the voluntary protection program, the Office of Technical Services will refer inquiries to one or more agencies expert in the particular field. Nothing in the program is meant to stop industrialsts and others who have regular contacts in the Government from using their usual channels when questions of security and the public interest arise.

The program of voluntary protection centering in OTS is concerned with information for release within the United States, which amounts to publication to the world. A separate service for the guidance of persons transmitting unclassified technical information directly to other countries is provided by the Office of International Trade of the Department of Commerce.

MODERN FOUNDRY METHODS...

MOLDING UNIT FOR 50 TONS DAILY PRODUCTION OF FINISHED CASTINGS

Chapman Valve Mfg. Co., Indian Orchard, Mass., makes all types of iron, steel, and non-ferrous valves and sluice gates, pouring the castings in its foundries and producing about 250 of its 300 tons per week of gray iron on a mechanized molding loop. The complete system, described here by Andrew T. Sproat, superintendent of foundries for Chapman Valve, and R. J. Wolf, Stone & Webster Engineering Corp., Boston, includes an eight-station molding turntable, an 82-car conveyor loop, a slinger for ramming, and a mechanical shakeout. Sand from the shakeout is returned to storage, mixed, and distributed mechanically. Castings produced on the loop range from 30 to 400 lb with section thickness from 3/8 to 2 in. The unit was put into an existing building which was not changed structurally in any way.

The molding sequence starts when a flask half is removed from the conveyor, just after shaking out, and is placed on one of the pin-lift molding machines. The patterns, which may be cast iron, aluminum, or wood, receive no parting material except an occasional dusting with powder when stickers start to appear. After slinger-ramming to a hardness of 80, the mold half passes under an automatic strikeoff which is spring-loaded to remove cleanly all the sand down to flask level.

Continuing in its clockwise travel on the turntable, the mold half is automatically raised off the pattern by

The molding turntable travels clockwise while Chapman Valve Mfg. Co.'s 82-car conveyor loop goes in the opposite direction. Cores are set at left, molds are closed at right. Both cope and drag pass under automatic strike-off. Unit is fully serviced by monorail system.

While mold at left is slinger-rammed, center mold is automatically struck off by spring-loaded scraper. Pin lift at right removes mold half from pattern for transfer to outside loop where molds are finished and closed.

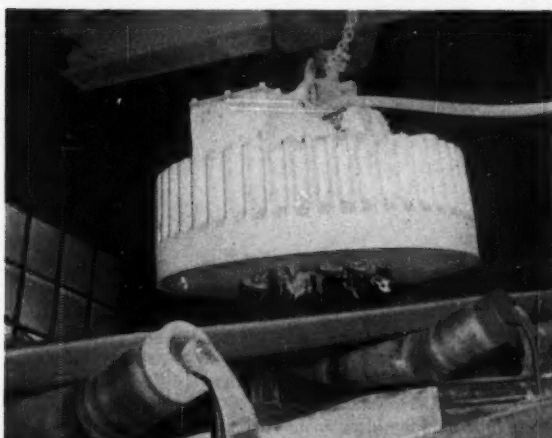
...MODERN FOUNDRY METHODS

lift pins and transferred by monorail air hoist to the mold conveyor which moves counterclockwise. Cores are set and molds closed immediately at the rate of one a minute, with mold halves being placed on a conveyor car or on another mold half depending on whether they are a drag or cope. Mold cavities receive no surface preparation except in the case of certain castings on which superior finish is required. These are sprayed with a proprietary burn-off mold coating which gives about an eighth inch skin drying effect.

Molds are poured at the pouring ramp from 2000-lb ladles suspended on a monorail circuit between the cupolas and the ramp. Smoke and fumes are removed by a side-exhaust ventilator at the ramp and are kept out of the shop by an exhausted cooling tunnel. Emerging from the tunnel, the molds travel about two-thirds of the way around the loop to the shakeout. Here the entire mold is transferred by electric hoist to a ventilated shakeout. Complete absence of bars, gaggers, and bottom boards makes shakeout simple and flasks are rapidly returned to the same conveyor car from which they are removed.

Sand goes through the grizzly to the under-floor sand conveyor. Castings pass into steel boxes which are handled by fork trucks. Under the floor, a pan conveyor carries the hot sand to a magnetic pulley where

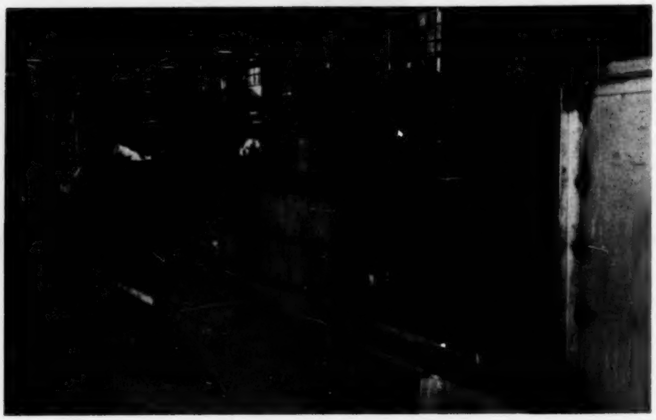
Sand is prepared in 3000-lb batches and checked several times daily to determine need for additions.



Auxiliary magnet over belt conveying conditioned sand to slinger removes metal which gets by magnetic pulley on hot-sand conveyor.

Conditioned sand travels from mixing room via inclined belt to molding unit. Dump buckets in foreground carry floor-molding sand.

MODERN FOUNDRY METHODS...



Molds travel from left to right past pouring ramp where metal is handled in 2000-lb pouring ladles. Conveyor moving at rate of a mold a minute carries molds past side-exhaust ventilation system into forced-draft cooling tunnel. Monorail loop for pouring ladles passes cupolas at far right where continuous tap melting unit discharges molten iron into intermittently tapped 2-ton forehearth.

Cooling side of conveyor loop with molds moving into the foreground brings them toward the shakeout station. Cooling tunnel in rear exhausts, along with fumes from pouring station hood, into atmosphere.

it is joined by spilled sand from the molding turntable. Passing through preliminary screening and aeration, the return sand travels by hooded conveyor belt (with suction removing steam and some fines) to a bucket elevator. This discharges into an inclined revolving cylindrical screen from which the sand goes to the storage hoppers. The material remaining in the screen—mostly core butts—goes down a chute to the outside of the building where it may or may not be recovered.

Sand from the storage hoppers is weighed out in a larry which services three sand mixers. Batches consist of 3000 lb of A.F.S. 70 fineness washed silica sand—the same base sand is used for cores and in the Chapman steel foundry for molding. No makeup sand is required, the approximately five tons of core sand per day going into the system keeping the sand volume at operating level. When the sand was originally prepared the additions consisted of 4 per cent western bentonite, ½ per cent wood flour, and 3 per cent water.

Additions to maintain sand properties—checked several times daily—are approximately ¼ per cent bentonite and less than that amount of wood flour. The sand laboratory uses an ignition test to check the need for wood flour. No seacoal is used in the sand mixture.

Each of the 82 cars in the conveyor is 42 in. long. Cast steel flasks of uniform size produced in the Chapman steel foundry are used. Parting surfaces, and tops and bottoms of all flasks are machined and the flasks are equipped with carefully fitted pins and hardened bushings. Flasks are 28 x 36 in. with both cope and drag being 14 in. high.

The exhaust from the shakeout, the pan conveyor, the elevator boots, and the top of the storage hopper at the cylindrical screen goes through a cyclone into a small bag house. Bags are shaken automatically and the bottom of the bag house is emptied periodically into a closed container used for transport to the dump.

Small monorail loop with electric hoist handles molds between conveyor and mechanical, ventilated shakeout. Empty flasks reach molding unit in background when replaced on conveyor car as next mold is picked up.

GRAY IRON SHRINKAGE RELATED TO MOLDING SAND CONDITIONS

Clyde A. Sanders*
and
Charles C. Sigerfoos*

This paper was presented at the Gray Iron Round Table Luncheon of the A.F.S. 54th Annual Meeting, at Cleveland, May 8-12, 1950, as part of the discussion on the effect of mold materials on metal shrinkage. Another part, covering an investigation conducted at Buick Motor Co., Div. GMC, Flint, Mich., by W. F. Bohm, appeared in the January, 1951 issue of AMERICAN FOUNDRYMAN.

MUCH TECHNICAL DATA have been accumulated regarding the various metallurgical aspects of the shrinkage of molten iron, and a number of conditions that promote shrinkage in iron are understood. For example, the influence of metal composition on the shrinkage of iron has been studied by many investigators, and it is common knowledge that a marked decrease in the carbon-silicon equivalent will increase the shrinkage problem in iron.

Other factors such as casting design, pouring temperature, gating and the size and arrangement of risers have also been studied in detail in order to control shrinkage defects. In giving each of these factors adequate attention, it is often assumed that soundness of the castings will invariably result. The fallacy of this assumption is recognized by all foundries that are in and out of severe shrinkage troubles when no appreciable changes have occurred in metal composition, pouring temperature, and gate and riser arrangements.

Sand Control Prevents Shrinkage

Associating shrinkage defects with certain sand conditions, in at least the gray and malleable iron foundries, is not essentially a new idea; investigations have been made to prove this theory. It can also be reported that several production foundries are preventing certain shrinkage defects by careful sand control.

The investigations of Womochel and Sigerfoos[33] in 1940 indicated that the piping tendency (apparent shrinkage) in risers attached to heavy ball-shaped castings could be decreased by harder sand ramming, using less moisture, adding sea coal and controlling the type and amount of clay and sand grain distribution. They advanced the theory that movement of the sand at the mold-metal interface was responsible for the difference in piping tendency.

Jeffrey[19] published a paper in 1944 in which he considered the influence of gas pressure in the mold. By varying the sea-coal content of the sand he was able to produce different degrees of metal shrinkage in round dumb-bell shaped castings poured in a malleable foundry. Jeffrey also considered the effect of the movement of the mold-metal interface before the metal became solid.

In the belief that the sand conditions are more closely associated with the shrinkage problems in iron than many foundrymen realize, it was decided to carry on further investigations on the problem, using a new molding technique and different materials, in the foundry laboratory of Michigan State College. This part of the investigation was made to study the effect of the following variations in the casting conditions

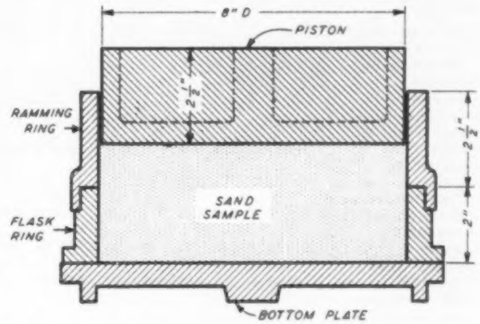


Fig. 1—Drawing of the sand ramming equipment used to produce test molds of the same hardness and density.

Fig. 2—The amount of a sand mixture required for a 2x8 in. mold section is calculated from the weight of the standard 2x2 in. specimen and placed in the mold.

Fig. 3—The mold section with ramming piston inserted is placed on the machine for the squeezing operation.

* Vice President, American Colloid Co., Chicago, and Associate Professor, Mechanical Engineering, Michigan State College, East Lansing, Mich., respectively.

TABLE 1 -- MOLDING SAND MIXTURES AND PROPERTIES

Mixture No.	1	2	3	4	5	6	7	8	9	10	11	12	14	15	16	17*	18*	19*	20*	21*	22*	23	24
Sand Type	(1)[a]	(1)	(1)	(1)	(1)	(1)	(1)	(5)	(3)	(6)	(6)	(6)	(7)	(7)	(7)	(10)	(10)	(10)	(10)	(10)	(10)	(1)	(1)
Sand lb	75	75	75	34	36	36	36	75	34	66	64.5	63	23.8	23.5	23	46	46	46	46	46	46	72	67.5
Sand Type				(2)	(2)	(2)	(2)		(4)				(8)	(8)	(8)	(11)	(11)	(11)	(11)	(11)	(11)		
Sand lb				34	36	36	36		34				23.8	23.5	23	46	46	46	46	46	46		
Sand Type													(9)	(9)	(9)								
Sand lb													23.8	23.5	24								
Fire Clay, lb	7.5			7.5					7.5	7.5	7.5	7.5											7.5
Western Bentonite, lb			3			3	3						3	3	3	4	4	4	4	4	4	3	
Southern Bentonite, lb		3			3																		
Sea Coal, lb										1.5	3.0	4.5				4	4	4	4	4	4		
Wood Flour, %													1	2	3								
Water, % by wt.	3.0	1.8	1.6	3.4	2.0	2.0	3.4	6.5	3.8	3.0	2.8	3.0	2 5	2.6	3.0	2.4	2.4	2.4	2.4	2.4	2.4	2.2	2.5
Core Oil, lb																							
Corn Flour, oz																							
Green Compressive Strength, psi	5.3	8.3	7.7	6.4	9.7	6.8	7.0	11.5	7.3	8.0	9.0	7.0	9.2	8.7	11.3	9.2	9.3	9.3	9.3	9.3	9.3	8.4	7.3
Permeability Number	210	270	270	73	90	90	35	16	44	115	90	73	200	115	90	90	90	90	90	90	90	230	160
Wt. of 2x2-in. Specimen, gram	168	162	161	169	159	158	169	164	182	170	169	169	160	160	171	162	162	162	162	162	162	161	168
Mold Hardness, 2x2-in. Specimen	73	80	71	70	80	74	72	81	69	76	77	76	77	80	79	75	75	75	75	75	75	80	77
Mold Hardness, 2x8-in. Specimen	68	83	76	70	77	74	70	80	65	72	75	76	78	76	85	77	77	74	74	74	74	79	78

[a]Numbers in parentheses correspond to sand type numbers shown in Table 2.

*17. Poured at 2700 F
*18. Poured at 2550 F
*19. Poured at 2400 F
*20. Poured in 57 sec at 2570 F
*21. Poured in 23 sec at 2625 F

on the degree of shrinkage: (1) Bond additions; (2) rammed density of the sand; (3) pouring temperature; (4) pouring rate; (5) sea coal additions; (6) moisture content; (7) oil sand molds; and (8) special ceramic materials.

In each case (with the exception of the moisture experiment) sand mixtures were used that would be acceptable for producing castings in a commercial operation. The mixtures used and the laboratory test results are shown in Tables 1 and 2.

It should be pointed out that the test results shown in Table I are indicative of each sand mixture in the green state. This report does not include values for hot strength, confined expansion, dry strength, etc. Future work is designed to associate these properties and stress-strain diagrams for sands with the shrinkage phenomenon.

Procedure for Density Control: The distinguishing feature of the 2-in. deep and 8-in. diameter mold sections is that they were rammed to the same height and density as the standard A.F.S. 2 x 2-in. laboratory sand specimen. This was accomplished by using the weight of the standard 2 x 2-in. specimen to determine the weight of the 2 x 8-in. mold section by direct ratio. For example, the ratio between the volumes is 1 to 16, and a sand that required 160 grams for the standard 2 x 2-in. specimen would require 2560 grams for the 2 x 8-in. mold section. Thus to make one mold section of this particular sand 2560 grams would be placed under the ramming piston for the squeezing operation (Fig 1). Each sample of the sand investigated and reported here was prepared in a similar manner and used in the mold at the same density as the laboratory specimen. Standard A.F.S. laboratory control methods were used for each mold section to verify its exactness, hardness and density.

The four mold sections were assembled as shown in Fig. 4. This arrangement provided a mold cavity 4 in. high and 3 in. in diameter, with a riser 2 in. high and 2 in. in diameter. The drag section rested on the perforated bottom plate and a mold weight was placed on the cope.

The cavity in the experimental mold was formed by cutting a 2-in. diameter hole in the center of the cope section, and a 3-in. diameter hole in the center of each of the two cheek sections. This was accomplished by an accurate sprue cutting operation in which doughnut shaped sheet metal gages were used over the mold section. These gages located the hole in the center and also prevented any possible distortion of the sand during the cutting operation. Figure 5 shows the four sand filled flask sections ready for assembly and the sheet metal gages, sprue cutters and the perforated bottom plate.

Melting and Pouring: All experimental heats were of plain gray iron melted in a rocking-type indirect-arc furnace. The charge consisting of pig iron and scrap steel was weighed out and charged in the same

Fig. 4—The four sections of the mold are assembled with the drag section resting on the perforated bottom plate. The mold cavity is 4 in. high and 3 in. in diameter, with a riser 2 in. high and 2 in. in diameter.

25	26	27	28	29	30	31	32*
(1)	(16)	(12)	(14)	(1)	(1)	(17)	(1)
68	96	48	48	96	96	48	127
		(13)	(15)			(18)	
		48	48			48	
	4	4	4	4	4	4	
3							
3							
0.75							
2.5	4.4	4.2	5.2	5.0	2.25	5.4	
							1.5
							14
8.6	6.2	9.1	5.2	4.2	8.3	13.6	
120	90	23	20	200	240	40	
163	157	190	158	163	159	280	
75	80	79	76	57	74	72	
76	69	77	64	48	72	75	

*22. Poured in 6 sec at 2700 F
*32. Baked 5 hr at 375 F

TABLE 2 -- TYPES AND SCREEN ANALYSES OF SANDS USED

Sand Types	Retained on Sieve, %												
	6	12	20	30	40	50	70	100	140	200	270	Pan	Clay
(1) Unbonded Core Sand			Tr	Tr	7	35	47	11	Tr				
(2) Bank Sand							10	45	31	12	1	1/2	1/2
(3) Coarse Silica Sand			5	57	4	1							
(4) Fine Washed and Dried Silica, Eastern							1	7	25	33	16	18	
(5) Fine Naturally Bonded, Eastern				Tr	Tr	Tr	2	11	19	20	13	25	10
(6) Lake Sand, 50-50 Coarse and Fine				1	14	29	41	13	1	1			
(7) Penn. Crushed Sand			1	3	10	20	30	24	10	2	Tr		
(8) Lake Sand, Coarse				2	27	48	21	2					
(9) Lake Sand, Fine						10	60	25	3	2			
(10) Silica, Washed, Dried, and Screened						3	27	41	23	4	2		
(11) Silica, Washed, Dried, and Screened					10	50	27	10	3				
(12) Kyanite, 35 Mesh													
(13) Kyanite, 100 Mesh													
(14) Mullite, 35 Mesh													
(15) Mullite, 100 Mesh													
(16) Fine Silica Sand						3	25	43	23	5	1	Tr	
(17) Zircon Flour, 100 Mesh													
(18) Zircon Sand, 60 Mesh													

NOTE: The sand type numbers shown in parentheses in this Table correspond to the numbers shown in parentheses with the sand types in Table 1.

Group A

manner for each melt (Table 3). When the metal reached a temperature of 2700 to 2750 F it was drawn from the furnace into a preheated pouring ladle. A late addition of ferrosilicon was made as the metal entered the ladle (50 grams of 90 per cent ferrosilicon was added to each ladle of 50-lb capacity).

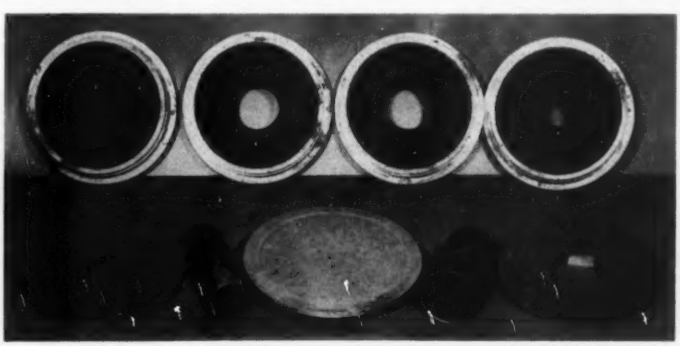
Unless otherwise stated, the pouring temperature was approximately 2600 F as measured by an optical pyrometer. When the temperature was correct, three experimental molds were poured from the same ladle during each test, with the exception of Group K in which four molds were poured. The charge and end average composition is shown in Table 3.

Group A: This group shows the effect of changing the bonding agent. Unbonded core sand was used in all mixtures. The moisture content varied slightly, as a workable mixture was desired. The mixture for specimen No. 1 was bonded with fire clay; No. 2 with southern bentonite; and No. 3 with western bentonite.

The fire clay bonded mixture produced the largest shrinkage cavity, with the western bentonite a close second. The southern bentonite bonded mixture had very little shrinkage cavity and showed only a small internal shrink area.

The deep shrink on the specimen produced in the fire clay bonded sand can be explained largely on the basis of differences in moisture content. The moisture

Fig. 5—After squeezing the four flask sections and perforated bottom plate are ready for assembly. Sheet metal centering gages are used for locating the 2- and 3-in. holes and preventing sand distortion during cutting.



content of the bentonite bonded sands averaged 1.7 per cent, and to obtain a workable mixture in the fire clay bonded sand it was necessary to use 3.0 per cent. It is believed that the higher moisture content promotes deformation of the sand at the mold-metal interface while the metal is in the liquid state.

In comparing the behavior of the southern and western bentonite bonded sands, it is believed that western bentonite allows the sand to deform under the heat and pressure of the liquid metal much more readily than southern bentonite. In other words, the southern bentonite appears to promote the desired stability to the mold-metal interface.

Group B: This group is similar to Group A in that the bonding agent was changed. The base sand, however, consisted of a mixture of 50 per cent lake sand

Group B

and 50 per cent bank sand. Specimen No. 4 was made in fire clay bonded sand; No. 5 had southern bentonite and No. 6 western bentonite.

Group B shows characteristics similar to those of Group A in that the fire clay bonded sand mixture (No. 4) produced the greater shrinkage, the western bentonite mixture (No. 6) the next, and the southern bentonite (No. 5) the least amount of shrinkage.

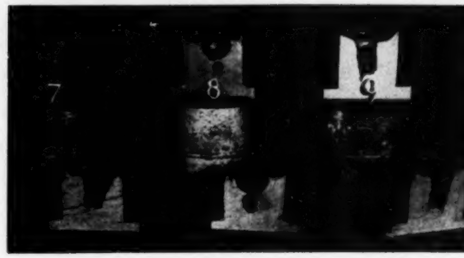
It is believed that sand grain distribution has little direct effect on metal shrinkage due to molding materials. It is also believed that if a finer sand is blended with a coarser sand the density is increased anu the mold is more rigid and less apt to move during the time in which it is subjected to high temperatures. However, a small increase in water is required to obtain proper workability. This slight increase of water may overcome the good effects of the wider sand grain distribution.

It is further believed that if the mixtures were kept dry and rammed or squeezed harder, improved results would be obtained.

The opinions of why sand mixture No. 5, which contained southern bentonite, showed less metal shrinkage have been given in Group A under mixture No. 2. In the sand mixtures tested, the southern bentonite bonded sands promote stability of the mold-

TABLE 3—CHARGE AND METAL COMPOSITION

Component	Large Pig, 44%	Small Pig, 44%	Low Carbon Steel, 12%	End Results
C, %	3.72	4.12	0.10	3.40
Si, %	3.60	1.23	low	2.23
Mn, %	0.97	0.88	0.40	0.85
P, %	0.179	0.24	low	0.20
S, %	low	low	low	low



Group C

metal interface and tend to decrease the shrinkage cavities.

Group C: This group shows the effect of two synthetic sand mixtures and one naturally bonded sand mixture on metal shrinkage. Specimen No. 7 was made in a synthetic sand mixture, composed of 50 per cent lake sand and 50 per cent bank sand bonded with western bentonite; No. 8 a fine naturally bonded eastern sand; and No. 9 a synthetic sand mixture, composed of 50 per cent lake sand and 50 per cent bank sand bonded with fire clay.

Specimens No. 7 and 9 of this group show again the deep shrinkage as promoted by the western bentonite and fire clay mixtures. Excessive water was used in mixture No. 8.

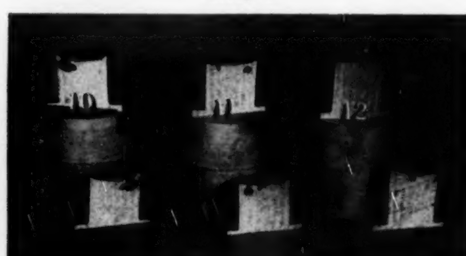
Specimens No. 7 and No. 9 contained metal shrinkage. Specimen No. 8 did not show metal shrinkage, but did show blows as the result of too hard squeezing at the machine, combined with a 6.5 per cent moisture content. Quite a bit of gas generated and bubbled through specimen No. 8.

It is believed that if the green compression strength of specimen No. 8 had been decreased, the moisture decreased, and the permeability slightly increased, such a casting defect would not have occurred, which indicates that very close and tight sands should be handled with care, particularly when they are used as new sands.

Group D: This group shows the effect of varied sea coal content on metal shrinkage. The mold for specimen No. 10 had a 2 per cent by weight addition of sea coal to the basic sand mixture; No. 11 a 4 per cent addition; and No. 12 a 6 per cent addition.

This group shows that if the sea coal is increased from 2 per cent to 6 per cent by weight to a given sand mixture that less metal shrinkage or piping occurs.

Group D



The dimensional proportions of the casting were more true in specimen No. 12 than in specimens No. 10 or 11.

It is apparent from these results that sea coal increases the stability of the mold-metal interface. It has been argued that the gas pressure generated from the sea coal after the metal has entered the mold tends to counteract the pressure of the metal and thus stabilize the mold. The gas pressure theory does not seem entirely feasible in the range of 73 to 115

Group F

permeability numbers as measured on these experimental sands. A more acceptable theory is based on the fact that sea coal, upon heating, cokes and expands. This expansion would tend to counteract the movement of the sand due to the metal pressure and reduce or eliminate the piping tendency.

Group F: This group shows the effect of wood flour additions as the wood flour was varied from 1 per cent through 3 per cent by weight of the mold mixture. The sand for specimen No. 14 contained 1 per cent wood flour; No. 15 contained 2 per cent; and a 3 per cent addition was made for No. 16. As the wood flour was increased there was a marked decrease in the shrinkage.

The results of this wood flour experiment compare favorably with those of Group D, which show the effect of sea coal. It is believed that about the same phenomena occur when wood flour is added to the sand as when the sea coal is used. Apparently the wood flour tends to stabilize the mold walls when the metal is liquid and permits less change in the mold cavity dimensions, which results in a casting of truer shape.

Group G: This group shows the effect of pouring at different temperatures, using the same sand mixture with the same approximate physical properties. Specimen No. 17 was poured at 2700 F; No. 18 at 2550 F; and No. 19 at 2400 F. As the pouring temperature dropped, the amount of shrinkage increased. The shape of the shrink was also observed to vary from a

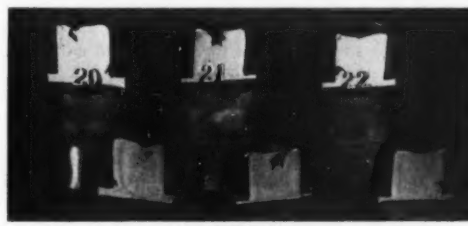
Group G

shallow depression for the hot-poured specimen to a deep hole for the cold-poured specimen.

The exception to the old rule that hot pouring tends to promote shrinkage is shown in this group. If volume change of the liquid iron were the only factor involved in the shrinkage shown on the tops of these specimens, it would be difficult if not impossible to explain the results obtained. Considering the theory of the effect of the mold-metal interface, as previously discussed in this report, a reasonable explanation can be offered.

It is believed that the 4 per cent sea-coal addition is the principal cause of the observed phenomena for, as previously mentioned, the sea-coal has a tendency to expand and coke as it is heated at the surface of the mold. This reaction was much greater in specimen No. 17 than in No. 19. The sand at the mold-metal interface of No. 17 resisted the fluid pressure of the metal to the point that very little shrinkage appeared at the top. Similar reasoning can be applied to specimen No. 19 for it was poured cold and the coking and expansion of the sea coal was not sufficient to hold against the pressure of the liquid metal.

Group H: The effect of varied pouring times on metal shrinkage is shown by this group. It was difficult to vary the pouring time without changing the pouring temperature, but the purpose of this group was to illustrate the differences of fast pouring, medium pouring and slow pouring. Specimen No. 20 was poured in 57 sec; No. 21 in 23 sec; and No. 22 in 6 sec. As the pouring time decreased, there was a slight increase in the shrinkage.



Group H

The general belief that there will be less shrinkage with slow pouring was confirmed. The actual difference was significant but not pronounced. It must be pointed out that the pouring temperature also varied during the pouring time and that specimen No. 20 was poured with colder iron than specimen No. 22. It is believed that this additional variable contributes to the small observed difference.

Group I: This group shows the effect of the same sand bonded with three different clay bonds, where one of the sand mixtures includes sea coal and wood flour to show the immediate effect of sea coal and wood flour in helping to eliminate metal shrinkage. The same metal was poured from the same ladle into the differently prepared green sand molds. Specimen No. 23 was poured in lake sand bonded with western bentonite; No. 24, lake sand bonded with fire clay; and No. 25, lake sand bonded with southern bentonite, and additions of sea coal and wood flour.

Group I

Specimens No. 23 and 24 produced in sands bonded with western bentonite and fire clay show shrinkage pipes in about the same magnitude as in the previous experiments. Specimen No. 25, produced in a sand containing southern bentonite, sea coal and wood flour, shows almost no shrink. The only sign of shrinkage on No. 25 is a slight depression above the fillet.

The test was a check on the previous observations and definitely proved that the mold materials have a very marked influence on the manner in which metal reacts during solidification. Sea coal and wood flour additions tend to eliminate the objectionable deformation of the mold interface that promotes this type of piping tendency. Southern bentonite also appears to improve the physical properties of the sand and helps to overcome the volume changes in the mold.

Group J: The effect of mullite and kyanite sands when used as replacements for fine silica sand is illustrated by this group. These three mixtures were bonded with western bentonite, and moisture was added to obtain the best workability. Specimen No. 26 was produced in a fine silica sand bonded with western bentonite; No. 27, a mixture of 50 per cent of 100 mesh kyanite and 50 per cent 35-mesh kyanite bonded with western bentonite; and No. 28 in 50 per cent 100-mesh mullite and 50 per cent 35-mesh mullite bonded with western bentonite. The moisture content was 6 per cent due to the higher percentage of 100-mesh mullite in the mixture.

High Moisture Promotes Shrinkage

Specimen No. 26, which was produced in silica sand, shows the most shrinkage. Specimen No. 28, produced in the mullite, shows a medium sized shrink, while specimen No. 27, which was made in the kyanite, shows the least shrink. The surface of casting No. 27 was rough in comparison to the other two specimens.

It was first believed that the more dense and higher refractory materials, when substituted for silica sand, would accelerate solidification and result in less shrinkage in the specimens. This viewpoint was not entirely correct, but other interesting points were observed.

It now appears that regardless of the sand or refractory material used as aggregate material, the shrinkage will be greater if the moisture content is high.

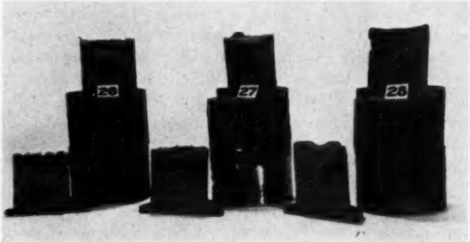
The kyanite sand mixture did not give as good a surface appearance as the other two mixtures. There appeared to be more metal burn-on and metal penetration than in specimens No. 26 or 28.

It was surprising to note that in the mullite sand specimen No. 28 the shrinkage occurred at the side and progressed into the casting. There was very little shrinkage on the top of the casting. It now appears that many other factors enter into metal solidification to a greater degree than density of molding materials.

Group K: This group shows how metal shrinkage can be overcome by using an oil-bonded core sand mixture, and how metal shrinkage can be lessened by using a denser and more refractory molding mixture. This is illustrated by specimen No. 31, which was made in the zircon sands. It is further indicative of what an increased moisture content can do in a given sand formula, as illustrated by specimens No. 29 and 30.

Specimen No. 29 was made in core sand bonded with western bentonite, and with a high moisture content; No. 30, the same sand and bond as No. 29, but with only 50 per cent as much moisture; No. 31 in a mixture of 6 per cent zircon flour and 50 per cent zircon sand bonded with western bentonite; and No. 32 in the oil bonded core sand and baked 5 hr at 375 F.

Greater shrinkage occurred in specimen No. 29 than in the other three. The next greatest shrinkage



Group J

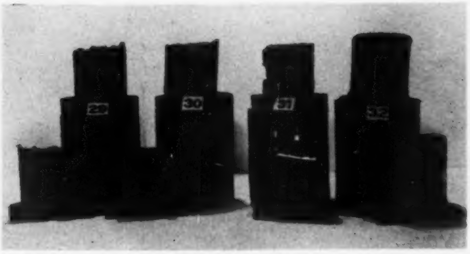
was in specimen No. 30, and the least shrinkage in specimen No. 32. There appeared to be a slight growth of the No. 32 specimen.

Specimens No. 29 and 30 were made as a further check on the effect of a change in moisture content. They offer additional proof that an increase in moisture will cause an increase in metal shrinkage.

It was at first believed that the dense zircon sand mixture would give less metal shrinkage than a silica sand mixture bonded in a like manner, but this was not entirely the case. Specimen No. 31 did show some shrinkage at the side near the top. However, little shrinkage or piping occurred on the top. Metal shrinkage was definitely less where zircon sands were used, and it appeared that there was a greater heat conductivity with the zircon sands as the skin of specimen No. 31 had a higher Brinell hardness than the other specimens. The zircon sands did have a chilling action on the metal as it entered the mold.

Specimen No. 32, which was cast in an oil bonded core sand, had no shrinkage and was a perfect sound casting. This confirmed past investigations and proved the point that oil bonded core sands affect metal shrinkage of castings very greatly, as there is no adverse movement of the mold interface with these sands.

Oil bonded core sands are very rigid, have greater mechanical strength, and expand rather than con-



Group K

tract when the metal is poured into the mold cavity. This is confirmed by observing the squeezing action on the metal while it is in a molten state in the mold. The silica grains expand and the metal exudes from the top of the mold as this expansion is taking place in oil bonded core sands.

Summary

(1) It was found that variations in mold materials will influence metal solidification.

(2) As carbonaceous materials such as sea coal and wood flour are gradually increased to a definite limit, the piping in the riser of the casting decreases.

(3) In comparison to western bentonite or fire clay, southern bentonite appears to lessen piping tendency.

(4) In these experiments wood flour decreased the piping tendency.

(5) As the moisture content of the sand increases the piping tendency increases.

(6) It appears that a dense, hard rammed mold will result in less movement of the mold-metal interface.

(7) The oil bonded core sand material produced a sound casting. It was observed that the metal exudes slightly from the riser instead of piping.

(8) Mixtures of molding sands and bonding agents are very complex, and it is illogical to make definite comparisons between different mixtures. Each base mixture should be considered on an individual basis.

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ASTM Invites Criticism Of Its New Radiographic Testing Practices Book

American Foundryman readers interested in radiographic testing are invited by the American Society for Testing Materials to submit criticism and comments on its newly-published *Recommended Practice for Non-Destructive Testing*, developed by ASTM's Committee E-7 on Non-Destructive Testing.

Available from ASTM Headquarters, 1916 Race St., Philadelphia 3, at 50 cents per copy, *Recommended Practices for Non-Destructive Testing* is divided into five main subjects: (1) Equipment and Calibration, (2) Exposure Factors and Arrangement of Parts, (3) Protection and Care of Films, (4) Processing Films and Viewing Radiographs, and (5) Records, Reports and Identification of Accepted Material. Effort was made by the Committee to include specific instructions for carrying out various steps of the radiographic process.

NORWEGIAN FOUNDRYMEN *Look At* AMERICA'S FERROUS FOUNDRIES

Last spring, an 18-man Norwegian Foundry Productivity Team, under the auspices of the Economic Cooperation Administration, visited 18 representative ferrous foundries in the United States and attended the 54th A.F.S. Foundry Congress & Show in Cleveland. As set forth here by Team Leader John L. Sissener, the impressions of this Norwegian team, composed of molders, foremen, and foundry managers, provide a keen insight into the American foundry scene — its men, methods and equipment.

John L. Sissener,
President,
Norwegian Foundrymen's Technical Association,
Oslo, Norway.

KEY TO AMERICAN INDUSTRIAL PROGRESS, my colleagues and I are convinced after a two months' tour of U. S. foundries, is mass production, achieved through a crystallization of many factors—free enterprise, standardization, larger foundry units, specialization, mechanization, improved foundry equipment and materials, planned production, use of timestudy and incentive systems, training within industry, high rates of pay, a marked degree of cooperation between workers and management, and production consciousness and a sense of teamwork among the workers themselves. The economies of mass production, coupled with the high wages paid American workers, have opened a huge home market for American goods and at the same time have made standards of living in the United States the highest in the world.

Visit 18 U. S. Ferrous Foundries

On our visit to the United States, the Norwegian team visited 18 iron foundries and two pattern shops. Apart from this, two team members visited eight steel foundries.

The foundries visited were all of different types —small and large, mass production and jobbing, captive and independent—making both heavy and light castings. For the purpose of this report, however, the majority of foundries that we will compare with those of Norway are small, producing approximately 3000 tons of ferrous castings annually. It is, of course, impossible to give an accurate picture of more than 2500 U. S. ferrous foundries merely by reporting on observations made in 18 iron foundries, but from talks with foundrymen of all levels and with management and labor officials, members of the team have formed what we believe to be fairly accurate impressions of the American ferrous foundry industry—impressions that should be of interest to all foreign foundrymen.

Comparing U. S., Norwegian Foundries

To compare the American and Norwegian foundry industries, it is first necessary to present a picture of the ferrous foundry industry in Norway. In 1949 a total of 110 Norwegian gray iron foundries produced some 50,000 tons of castings. Half of this output was in small, specialized work and the balance mostly jobbing work in captive and independent foundries, with castings delivered to machine shops. Among the small castings, stove plates, household utensils, and pipe fittings form an important part. Of the larger castings the bulk is made up of diesel engines, steam engines, paper and sawmill machinery, motors, machinery for water works, and chemical equipment.

In comparing the castings productivity of the two nations, the yardstick of manhours per ton of castings produced must necessarily involve such uncertain factors as variance in types of castings produced in the two countries, and the amount of indirect labor involved in castings production.

In analyzing Norwegian foundries, we find that the smaller the foundry the more manhours required to produce a ton of castings. The 18 foundries visited in the United States showed that from 40 to 70 manhours are required to produce a ton of small castings, and 60 to 80 hours for heavy castings. In Norway, 115 manhours are needed for a ton of small castings and 150 hours for heavy castings, with much higher

or lower figures for extreme cases. In spite of these comparative figures, since the American molder earns three times as much as his Norwegian counterpart, castings can be produced more cheaply in the United States only by mass production.

U. S. foundries tend more toward specialized castings production than do those in Norway. This is not, however, the sole factor in American mass production. We found that even small, non-specialized foundries can effect great savings in time and labor by using pattern plates. We saw a number of cases where external cores were used on patterns of intricate shapes, eliminating need for drawing loose pieces. In this way, much skilled foundry work can be replaced by unskilled.

In the big American shops, the sand slinger has revolutionized the foundry and today, when portable sand slingers are available at comparatively low cost, they are also revolutionizing the small and medium foundry. Here again adequate patterns play an important part, since the slinger must be run at at least 40 per cent capacity per day.

Note Contrasting U. S. Molding Systems

Two contrasting molding systems are employed in U. S. foundries—(1) use of large floor space, snap flasks, portable molding machines, sand shoveling by hand, floor molding, shaking out molds at night on the floor, and preparation of sand at night with a sand cutting machine, and (2) use of snap flasks, stationary machines, central sand mixing unit feeding into hoppers located above molding machines, with all molds carried by conveyors to mechanical shakeouts throughout the day.

Advantages of these two systems to a foundry depend upon space and capital available and whether it is cheaper to enlarge floor space than to install roller conveyors and a central sand system in the old plant. The first system requires more skill on the part of the molder and is usually accompanied by higher wages. System No. 2 undoubtedly results in a larger output of castings per square foot of floor space but total production per worker is not necessarily greater than under System No. 1.

Team members observed that large snap flasks are widely used in American foundries and, in general, flasks are preferred to pitwork. Use of loam molding is rare in U. S. foundries. In Norway a craftsman molder actually outproduced the American sand slinger-pattern method of molding a diesel engine cylinder liner by making a swept-up loam mold which can be used again and again. Nothing, however, can beat the productivity of U. S. automotive foundries. Team members watched 42 men with two molding machines mold, assemble, pour and shake out 120 Ford V-8 cylinder blocks in an hour. This does not include coremaking, which was done separately. In a case such as this, machinery is actually the producing element and the only objection is that the system must run at full capacity every day.

Lauds U. S. Materials Handling

Foundry mechanization requires advanced means of transportation, whether by cranes, monorails or trucks and in this respect American foundries are far ahead of those in Norway. Larger numbers of more powerful cranes and trucks are used.

We found much of interest in the mechanical charging of cupolas and saw two men and a driver charge 120 tons in a day with a skip hoist.

Most U. S. foundries use two cupolas, although some have only one. The forehearth, in widespread usage in Europe, seems rarely used in the United States. In Norway and Sweden, low-carbon charcoal pig iron is used to make high-grade iron. Little steel scrap is charged. A survey of 500 American foundries showed that 15 per cent steel scrap and no pig irons other than ordinary blast furnace irons were used. Cupola control is far more advanced in the United States and higher coke beds and better-quality cokes are used than in Scandinavia. Air placement of cupola lining, inoculated irons, and airweight control created great interest among members of the team.

Finds Skin-Drying Widely Practiced

With regard to drying ovens, it was found that American foundries widely use skin drying, which can be applied to great advantage, since pouring is done every day. In Norway we have new Swiss-made portable electric drying units which have proved very useful for complete and skin drying.

Coreblowers, we observed, are more useful in the United States, where foundries are specialized, than in Europe, where coreblowers are used to a limited extent. After seeing mechanical shakeouts in action, we believe they are very efficient tools and save greatly in manpower.

One of the most important observations we made

Members of the ECA-sponsored Norwegian Foundry Productivity Team are interested onlookers as Charles Mooney operates a coreblower during the team's visit to Link-Belt Co.'s Olney Foundry Division, Philadelphia, last May.

during our tour was that of the care and control American foundrymen give their molding sands. This is especially important to high productivity because it eliminates unnecessary molding, scrap losses, and excessive use of nails and gaggers. Sand in American foundries, we found, is more uniform, drier, and has much greater strength and permeability than that in Norway.

We also noticed the extensive use of pitch. In fact, one foundryman told us, "If I had no pitch, I would shut down my foundry." We Norwegians cannot see the advantage in attempting to replace seacoal in green sand with pitch, but we do recognize the advantage of pitch in dry sand molds.

We found one foundry where fair results had been obtained by replacing seacoal with wood flour. Since we are very interested in foundry sanitation, we found these results promising.

In Norway we have billions of tons of olivine (Mg_2SiO_4) as solid rock which can be crushed into molding sand. This sand is refractory and can be used in applications where there is a possible silicosis hazard. Apart from this, we have found no really good natural sand in Norway.

Cites Central Sand Preparation Advantages

We noticed that U. S. foundries trend toward use of a central sand preparation unit instead of individual sand heaps on the floor. This offers many production advantages.

Foundries in Scandinavia try to keep molding and pouring operations separated to insure better working conditions and we believe this practice could well be adopted by American foundries. In the United States, cleaning rooms are separated from the main foundry and molds are shaken outside the main foundry, or if shaken out indoors, extreme care is taken to insure proper extraction of dust. We found that some American foundries set an example to the world in good foundry housekeeping but that others were far behind in this respect.

Members of the Norwegian foundry productivity team benefited greatly from a first-hand study of American management policies. Until a few years ago, management's functions consisted largely of constructing, selling, and financing. Today, as never before, management is concerning itself with the welfare of its workers. Treatment of industry's most important single factor, personnel, should be the personal responsibility of the head of the firm. Human relationships, industrial relationships, and public relations will certainly take up much of management's time, but it is necessary.

From our observations, we believe the foreman, the superintendent, and the foundry manager to be the most important executives in the American foundry industry. We studied U. S. training-within-industry systems closely and found that their importance in training executives cannot be overemphasized.

The teamwork and cooperative spirit fostered by American management is, we believe, a large factor in America's high rate of productivity. Incentive, bonus, and job evaluation systems as practiced in America are little known in Norway and are, in the author's opinion, the surest way to increase production. Division of jobs into elements to determine correct piece rates is also valuable.

Last but not least, the job of management is to plan work in advance as thoroughly as possible in order to avoid wasting of time. From our American tour observations, we believe that all foundries, whether large or small, should have planning departments consisting of at least one skilled craftsman, one engineer, and a patternmaker, working at least part of the day. This department determines (1) size and type of castings that the foundry can make or not make, (2) time of delivery, (3) use of patterns or pattern plates, and makes sketch of molding procedure, (4) gating and risering, (5) weight of piece to be poured, grade of iron to be used, daily melting schedules, (6) flask number and size and when flask and pattern shall be given molder, (7) time studies and rate fixing, and (8) preparation of work prior to molding.

Greater productivity can be achieved by advance planning and by dividing work into operations such as molding, assembling, and pouring. In this way much of the brainwork left up to the individual molder can be done in the planning office by the engineer and patternmaker, who provide the molder with good productive patterns and with patterns for gating and risering the casting. The day of "each man to his own system" is disappearing as the foundry industry becomes a science through the free interchange of foundry technical knowledge.

One day the Norwegian team visited a small foundry. Noticing the many automobiles parked outside, one of our team members asked "Why so many cars outside?" An American molder answered him, "We all have our own cars. If you don't believe it, I'll drive you home in my new car and I'll show you my new television set." No wonder the Norwegian found this hard to believe—he would have to work seven times as long to buy a car as his American colleague, twice as long for a loaf of bread and three times as long for an article of clothing.

Likes U. S. Worker's Mental Attitude

The American foundryman is far ahead of his Norwegian colleague, not in craftsmanship, but in mental attitude. He is production-minded and is given every incentive to be so, he takes pride in his work and, in his own words, "My machine is the best in the world." This healthy mental attitude, coupled with the constant striving for improvement of methods, products and working conditions that characterizes American Industry, is proof that the spirit of America's pioneers still inspires the whole nation.

New, Smaller A.F.S. Pins Available

Contrasted here in actual sizes are the old A.F.A. pin and the new, smaller A.F.S. pin, reduced in size by popular demand of members of the Society. The new 3/8 in. diameter pins will be traded for the old A.F.A. pins at no extra cost or are available at $1 each from A.F.S. National Office, 616 S. Michigan, Chicago 5.

Air Pollution Control . . .
WEST COAST INSTALLATION PASSES TEST

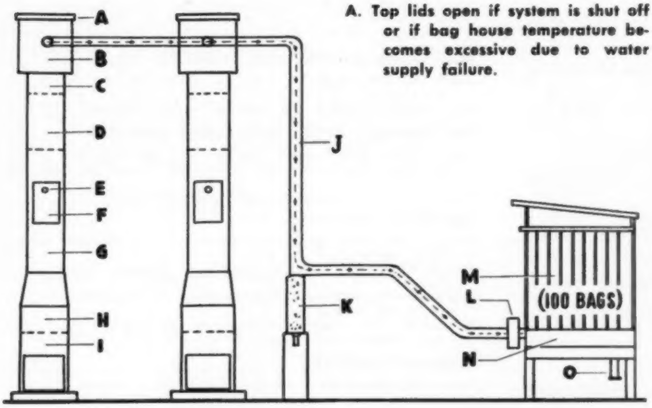
WITH A TOTAL EMISSION RATE of only 0.24 lb per hr, the cupola smog control unit of General Metals Corp., Los Angeles, cuts down air pollution far below the allowable total rate of emission of 10.3 lb per hr. Figures apply to a typical process weight of 84,000 lb of metal, 11,270 lb of coke, and 2,250 lb of stone, for a 560-min heat. Primary job of the new smog control equipment is to catch the fine particles (about the same diameter as are found in cigarette smoke) which evade standard cupola emission control units. Carbon monoxide is burned in the upper part of the stack by an auxiliary burner and the hot gases are wet-scrubbed at the stack top. This eliminates about 30 per cent of the coarse particles and reduces gas temperatures from about 1700 to 1000 F.

A 2-ft diameter downcomer leading to a coarse dust chamber and from there to the bag house reduces the gas temperature to 500-650 F by radiation. The bag house blower sucks smoke from the duct and blows it into the 100 fiber glass bags which act like vacuum cleaners in capturing smog particles. Each bag is 15 ft long and a foot in diameter. The bags are shaken manually to deposit the accumulated smog in five hoppers which are emptied daily. The bags are silicone treated and withstand temperatures up to 750 F.

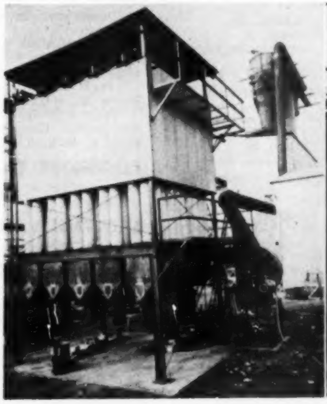
Handling about 13,000 cfm of smoke, the bag house accumulates about 50 lb per hour of particles which have the appearance of finely powdered chocolate milk. This material is approximately 50 per cent silica, 30 per cent iron oxide, and about 20 per cent lime, and manganese and sodium oxides.

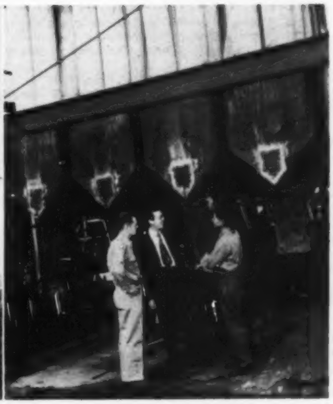
"The Round Table" in the March issue of AMERICAN FOUNDRYMAN will include a discussion of the meteorological conditions which influence air pollution in Los Angeles and other industrial areas.

Diagram of General Metals Corp.'s Smog Control System



A. Top lids open if system is shut off or if bag house temperature becomes excessive due to water supply failure.
B. Water sprays cool hot gases.
C. Gases, 28,000 cfm, at 1,500 to 1,750 F.
D. Carbon monoxide plus air burns to carbon dioxide; all combustibles consumed.
E. Gas burners ignite and burn carbon monoxide.
F. Charging doors, 4,000 cfm of air sucked in here.
G. 18 per cent carbon monoxide.
H. Melting zone, temperature 2,650 F.
I. 2,000 cfm air blast at tuyeres.
J. Steel duct 24 in. in diameter.
K. Coarse dust chamber.
L. Exhaust fan, suction from cupola to fiber glass bags.
M. Bag house.
N. Five dust hoppers.
O. Dust hopper clean-out.





Right—Bag house with suction fan in foreground which brings exhaust from cupolas into the 100 glass bags where smog particles are trapped.

Far Right—Examining the hoppers into which smog particles drop for daily removal from the bag house are (starting left) Charles Dixon and Frank Stamm, General Metals Corp., Los Angeles, and W. O. Jenkins, Whiting Corp., Harvey, Ill.

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M.I.T.

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OREGON STATE COLLEGE

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INTERNATIONAL

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Japan

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South India

V. S. Kudva, Managing Dir., The Canara Workshops, Ltd., Mangalore, South India.

Publish Wisconsin Chapter Directory

Recently published is the annual 57-page *Directory and Program* of the A.F.S. Wisconsin Chapter. Included in its content are the President's Message, a history of A.F.S. and the Wisconsin Chapter, By-Laws, the Chapter's 1950-51 program of meetings and events, a list of Chapter committees, and a complete tabulation of names, firms and addresses of Life Honorary, Sustaining, Company and Individual members of the Wisconsin Chapter.

William Davis Moore Dies

William D. Moore

Past Director of American Foundrymen's Society William Davis Moore, retired president of the American Cast Iron Pipe Co., Birmingham, Ala., died November 10 in a hospital in that city. Mr. Moore was born at Hannibal, Mo., in 1882 and received his first training as an engineer with Morgan Engineering Co., Alliance, Ohio. After later serving a year with the Tennessee Coal, Iron and Railroad Co., Ensley, Ala., Mr. Moore joined American Cast Iron Pipe Co. in 1908 as a mechanical engineer. He rose through several executive positions in the company to become its president in 1924. Known for his many mechanical developments in cast iron pipe production, Mr. Moore remained president of American Cast Iron Pipe Co. until his retirement in 1946. Mr. Moore served as a National Director of American Foundrymen's Society from 1931 to 1933 and as a director of the Steel Founders' Society of America.

American Foundryman on Microfilm

Microfilm copies of American Foundryman, occupying only a few cubic inches of space, will soon be available for volumes 17 and 18 covering the complete 1950 edition. The 12 issues for 1949 as well as those for 1950 can be obtained from University Microfilms.

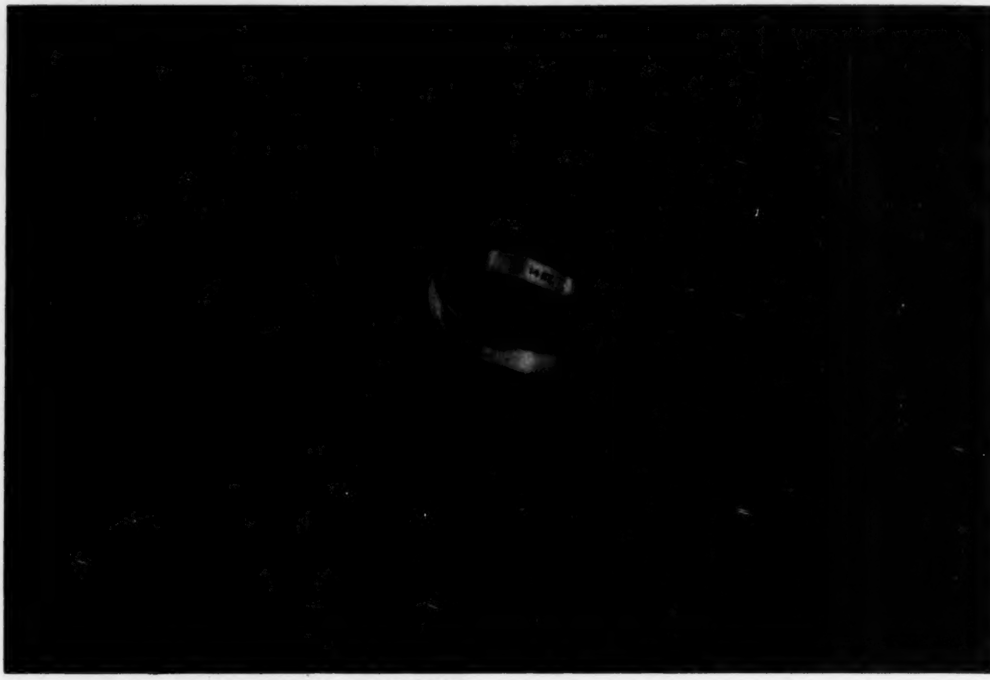
Under a new microfilming plan, an entire volume or volumes of a magazine can be kept on a single roll of film, effecting a great saving in library shelf space.

Sales are restricted to subscribers and film copy is distributed only at the end of the volume year. Information and films can be obtained from University Microfilms, 313 N. First St., Ann Arbor, Mich.

Reprints of 1950 Hoyt Lecture — "Operation of the Cupola" Available

Newly available are reprints of the 1950 Charles Edgar Hoyt Annual Lecture, technical highlight of the 54th A.F.S. Foundry Congress and Show, held last May in Cleveland. Presented by W. W. Levi, metallurgist, Lynchburg Foundry Co., Radford, Va., *"Operation of the Cupola"* appears in Vol. 58, A.F.S. Transactions (1950). Twenty-page reprints of Mr. Levi's paper are now available to A.F.S. members at $.60 each and to non-members at $1.00 each from A.F.S. Headquarters, 616 S. Michigan Ave., Chicago 5, Ill.

In *"Operation of the Cupola"* Mr. Levi discusses such elements of cupola practice as charging equipment, front-slagging cupolas, balanced-blast blast control, moisture content, control of blast, mechanical charging equipment, inoculants, carbon equivalent, and calculation of carbon content of iron. Photographs, charts and tables illustrate the text.



Today all metals are Precious!

As if you didn't know!

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The process conserves metal because pieces can be cast to close dimensions. It conserves metal because it minimizes rejects of castings—cuts down the scrap pile. It conserves metal by greatly reducing the amount of machining required, often just a finish cut being needed.

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If you have not yet looked into this economical process which makes it necessary to handle only 10 per cent of the sand normally handled, by all means do it now. Send for your free copy of our 16-page illustrated booklet, "BAKELITE Phenolic Resins for the Croning Process."

It contains helpful information on BAKELITE Resin Binders, as well as a special BAKELITE wetting agent and a parting agent developed for the process by BAKELITE engineers. Reference is made also to selection of sands, pattern preparation and core making. Simply fill out and mail the coupon below.

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WHO'S WHO

Clyde A. Sanders, who with Charles C. Sigerfoos, reports on investigations undertaken by the authors at Michigan State College in *"Gray Iron Shrinkage Related to Molding Sand Conditions,"* Page 49, is well-known to members of A.F.S. for his many appearances before chapter, regional and national meetings of the Society as a speaker on foundry sands and sand practices. Before studying ceramic engineering at Ohio State University, Mr. Sanders was employed by several firms but became interested in clays and sands while working with Prof. Wilbur Stout, Ohio State geologist. After a period with the Lawrence Clay Co., Mr. Sanders joined the American Colloid Co., Chicago, in 1941. Entering the Navy shortly afterward, he was commissioned and selected to study Naval rocket warfare at the California Institute of Technology, after which he saw service in both the Atlantic and Pacific theaters of war. He was elected a vice-president of American Colloid Co. in 1948.

C. A. Sanders

C. C. Sigerfoos, co-author with Clyde A. Sanders of *"Gray Iron Shrinkage Related to Molding Sand Conditions,"* Page 49, is associate professor of mechanical engineering at Michigan State College, East Lansing, Mich., where he collaborated with his co-author in making the investigations reported in the article on Page 49. A native of Elkhart, Ind., Prof. Sigerfoos attended Purdue University, receiving his B.S. in mechanical engineering in 1930, serving as an instructor there from 1930 to 1933 and obtaining his M.S. in 1935 after serving two years as instructor of foundry practice at Manual Training High School, Indianapolis. Joining the faculty of Michigan State College as an instructor of foundry practice, he is now associate professor of mechanical engineering there. Long active in A.F.S. chapter and committee work, Prof. Sigerfoos is past chairman of the A.F.S. Central Michigan Chapter and is a member of the American Foundrymen's Society Sand Division's Mold Surface Committee.

C. C. Sigerfoos

John L. Sissener, author of *"Norwegian Foundrymen Look at America's Ferrous Foundries,"* Page 56, is president of the Norwegian Foundrymen's Technical Society, Oslo. Last year, Mr. Sissener headed an 18-man team made up of men from all levels of the Norwegian foundry industry, who visited 18 ferrous foundries and two patternshops in the United States under the auspices of the Economic Cooperation Administration, and who attended the 54th A.F.S. Foundry Congress & Show in Cleveland last May. As author of the article, Mr. Sissener is spokesman for the 18 members of the Norwegian team, who concur in saying their visit to the United States was an "unforgettable experience."

J. L. Sissener

Albert L. DeSy, author of *"Eliminate Second Inoculation in New Nodular Iron Process,"* Page 41, is well-known to foundrymen of America and Europe for his extensive research on nodular graphite cast iron. A graduate of the University of Ghent, where he is today a full professor and head of the Metallurgy Department, Dr. DeSy worked in foundries in Czechoslovakia and Belgium before joining the University's faculty as an instructor in 1935. Dr. DeSy has written nearly a score of papers on metallurgy of steel and iron, polishing of metals and on nodular iron, two of which have appeared in American Foundryman, and is author of three standard works on metallurgy.

A. L. DeSy

LETTERS TO THE EDITOR

Finds Square Nodules In Nodular Iron

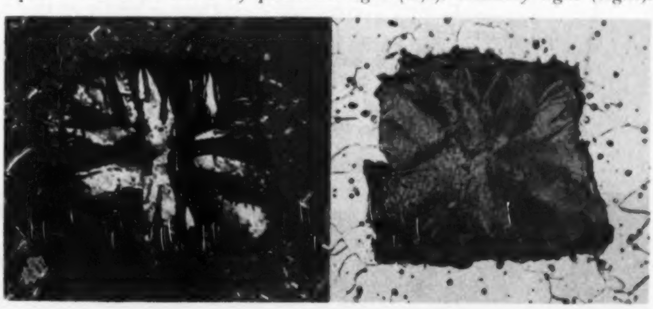
The study and practical application of nodular iron has heightened interest in unusual forms or shapes of free graphite in cast iron. We have seen pseudo-flakes, true spherulitic nodules, intergrown nodules, radial type nodules, concentric type nodules, "circular" graphite as shown by Donoho, as well as all the forms in which ordinary flake graphite can be found.

Recently, a new and different shape reared its head from a microscope field and was successfully captured and recorded. The accompanying photomicrographs at 750 diameters, one with plain light and one with polarized light, show its outline to be square, and definitely so. The iron was quenched and tempered to about 170 Brinell. Occasional other square nodules have been noticed.

The genesis or mode of formation of this shape of graphite adds another to the many unanswered questions in the metallurgy of nodular iron, although this one is probably of academic interest only. The mechanical properties of iron containing all square (or cubical) nodules are likely to be poor.

J. E. Rehder,
Foundry Engineer,
Mines Branch,
Ottawa, Ont.

Square nodule at X750 by polarized light (left), ordinary light (right).



MEXICAN CORDIP®—ANOTHER NEW PRODUCT DEVELOPED BY THE UNITED STATES GRAPHITE COMPANY

NEW HIGH TEMPERATURE WASH GIVES SMOOTHER, TRUER CASTINGS

Mexican Cordip is just one of the many new products that are continually being developed by the research facilities of The United States Graphite Company. Mexican Cordip is a high temperature coating that gives castings maximum surface smoothness. Dry or green cores maintain true dimensions because Mexican Cordip *will not build up or run on core surfaces.* It penetrates sand to an effective depth to prevent burn-in. Since its development in the laboratories, Mexican Cordip has proven its worth in daily use in some of America's finest foundries. Mexican Cordip is supplied in powdered form complete with binder and is *easy to prepare and use* either as a spray or dip. Other grades of Mexican Graphite foundry facings are available to suit your particular casting operations.

1⅛" cores with small cylindrical cavity being charged with metal (left) for insertion into the hot zone of the Dilatometer (right). Metal melts to form a small pellet. After cooling, the core and casting are studied for ease of removal, coating remaining, burn-in, and surface appearance.

Small cupola used to simulate actual pouring conditions at The United States Graphite Company laboratory.

MODERN LABORATORY DUPLICATES ACTUAL FOUNDRY CONDITIONS FOR BETTER PRODUCT RESEARCH

Old-time foundry men and newly graduated metallurgists alike who have visited The United States Graphite Company's neat, new foundry research laboratories in Saginaw have been enthusiastic about the completeness of the equipment, *the thoroughness of the tests*—and the extent to which the engineers here are going in order to develop even better Mexican Graphite products for America's foundries.

In this amazingly complete laboratory is a perfect little 4½" diameter cupola that exactly duplicates the results of its big brothers on production. An electric furnace and a Dilatometer are used to study the effect of temperatures up to 3000° F under just about any atmosphere. Metallurgical microscopes are used for closer study (up to 3,000 diameters) of the sand-metal interface of experimental cores and molds.

There is a core oven and complete sand testing equipment so that precise studies can be made of the penetration, effect on surface, and physical characteristic of sand when using various types of Mexican Graphite washes.

Within this modern laboratory there is even a chemical laboratory *fully equipped for making every kind of test and analysis* that is likely to apply to foundry products and foundry practice.

It is largely because of the completeness of this modern laboratory—and the skill, knowledge and creative ability of the engineers here that United States Graphite Company products are so effectively saving production time, cutting costs and helping to assure better castings in America's leading foundries today. *This laboratory is at your service.* Call or write us.

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THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION • SAGINAW, MICHIGAN

FOUNDRY *Personalities*

Donald H. Workman, a member of the staff of Gray Iron Founders' Society, Cleveland, since 1948, was recently named executive vice-president of the Society at a meeting of the GIFS Board of Directors. Mr. Workman, former promotion manager of the Society, has been serving as

D. H. Workman

acting executive vice-president since last October. A graduate of the University of Pennsylvania's Wharton School in 1938, Mr. Workman was associated with Philadelphia's Electric Co.'s Personnel and Public Relations Department prior to joining GIFS in March, 1948. A World War II Navy officer, Mr. Workman served in the Bureau of Ships, Washington, D. C., and later as administrative officer of LeHavre, France, Naval Base.

Franklin P. Goettman, formerly sand foreman, Duriron Co., Inc., Dayton, Ohio, has been named manager of the Standard Sand Co., Grand Haven, Mich. A graduate of Pennsylvania State College in 1941, Mr. Goettman served with the Navy in World War II. Active in the A.F.S. Sand Division, he is a member of its Executive Committee, Core Washes and Pastes Sub-Committee, Flowability Committee, and chairman of the Division's Green Sand Properties Committee.

Arthur W. Stolzenburg, formerly process and products engineer at Aluminum Co. of America's Detroit plant, is now a member of the staff of Alcoa's Bellwood, Ill., plant. Mr. Stolzenburg has for many years been active in the A.F.S. Aluminum & Magnesium Division and is currently a member of its Executive Committee and Program & Papers Committee and is chairman of the Division's Foundry Terminology Committee.

Norman F. Smith, formerly vice-president and general manager of the Osborn Mfg. Co., Cleveland, was elected president of the company at a Board meeting January 9 and succeeds **Franklin G. Smith,** founder and president of Osborn since 1892, who was elected chairman of the

N. F. Smith

Board. The new president is 48 years old and has been with the company since his graduation from Dartmouth College 25 years ago, when he began as a laborer in the Woodworking department. In 1927, Norman Smith was named assistant manager of Rubico Brush Manufacturers, Inc., New York subsidiary of Osborn and was treasurer of that organization in 1935, when he was named treasurer of the parent company. He was named vice-president and general manager in 1938.

Harold H. Judson, Past National Director of A.F.S., has been named plant manager of Kencroft Malleable Co., Inc., Buffalo, where he will have complete charge of all foundry operations and will assist Company President Ralph T. Rycroft. A graduate of Worcester Polytechnic Institute, Mr. Judson has had extensive experience in foundry management, serving as foundry superintendent of Goulds Pumps, Inc., Seneca, N. Y., for nine years and as foundry manager for Minneapolis-Moline, Inc., Minneapolis, for several years, prior to joining Kencroft. Mr. Judson presented the 1936 A.F.S. Exchange Paper to the Institute of British Foundrymen.

Malcolm W. Valentine, superintendent of inspection and quality control, Hunt-Spiller Mfg. Corp., Boston, and Joseph A. McNulty, received 35-year service pins in an informal plant ceremony recently.

William S. Lowe, executive vice-president of the A. P. Green Fire Brick Co., Mexico, Mo., was recently elected president of the company, succeeding **Robert S. Green,** who recently resigned but who will continue as a member of the Board of Directors and is currently doing re-

W. S. Lowe

search work at Battelle Memorial Institute, Columbus, Ohio. Mr. Lowe, who is 42, attended Cotner College, Lincoln, Neb., for one year and graduated from South Dakota State College in 1931 with a B.S. in electrical engineering. He continued as a graduate student at South Dakota State for two years, later serving as an instructor in mechanical engineering and as athletic coach prior to joining General Electric Co. from 1934 to 1942, SKF Industries from 1942 to 1944 and as chairman of the board and president of Winsted Hardware Mfg. Co., Winsted, Conn., from 1944 to 1949, when he joined A. P. Green.

John A. Bukowski, formerly works metallurgist for Worthington Pump Co., Harrison, N.J., has been named general superintendent of Atlas Foundry Co. and Atlas Stainless Steel Co., Irvington, N. J. He is a graduate of the Buffalo College of Chemistry and Metallurgy.

Ray E. Kalmbach, formerly foundry superintendent for Nash-Kelvinator Corp., Kenosha, Wis., has been named general manager of Wilson Foundry & Machine Co., Pontiac, Mich., subsidiary of Willys-Overland Motors, Inc. A veteran of 30 years in the foundry industry, Mr. Kalmbach was in charge of all Ford Motor Co. aluminum foundries in World War II, later serving as foundry consultant to General Motors Corp., prior to joining Nash-Kelvinator.

George W. Starr, vice-president in charge of sales for Ohio Ferro Alloys Corp., Canton, Ohio, until his semi-retirement in 1947, has now ceased all business activity and is residing at 141 High St., Canfield, Ohio.

Norman C. Minehart has been named vice-president in charge of the Abrasive Division of Charles H. Besly Co., Chicago. Also announced by that company is the appointment of **Jack T. LeBeau** as manager of its Abrasive department. Both men will make their headquarters at the company's general office at 118 N. Clinton Street, Chicago.

George E. Tate, since 1946 assistant treasurer of the Federal Foundry Supply Co., Cleveland, has been named treasurer of the company. Now in his 25th year with Federal Foundry Supply, Mr. Tate was for many years purchasing agent for the company before his appointment as assistant treasurer.

OBITUARIES

Frank T. McQuillin, 58, vice-president in charge of production, Standard Buffalo Foundry, Inc., Buffalo, died November 19, following a prolonged illness. A Past Director of the A.F.S. Western New York Chapter, Mr. McQuillin began his foundry career as a patternmaker in Norwalk, Conn., and Syracuse, N. Y., before joining Standard Foundry, Buffalo, in 1912. When this organization was consolidated with North Buffalo Hardware Foundry in 1936 to form Standard Buffalo Foundry, Inc., Mr. McQuillin was named manager of plant operations and in 1949, vice-president in charge of production.

Ernest P. Waud, chairman of the Executive Committee of Griffin Wheel Co., Chicago, died December 22 in Chicago. Mr. Waud joined Griffin Wheel's Denver plant in 1905 and was soon transferred to Chicago, where he was elected assistant treasurer. In 1917, Mr. Waud was named assistant to the president, in 1919 vice-president and in 1927 president of the company. A director since 1913, he was elected chairman of the Executive Committee in 1948.

Robert Hannan, 34, North Central District representative for Beardsley & Piper Division, Pettibone Mulliken Corp., Chicago, and **Sheldon Piper**, 35, son of W. F. Piper, founder of Beardsley & Piper, were found dead in the wreckage of their private airplane near Palatine, Ill., January 7, after a three-state search, begun when they were reported missing on the return flight of a business trip to Minneapolis. Mr. Hannan joined Beardsley & Piper in 1942 and since 1945 had been a district representative in Chicago and the North Central states. Sheldon Piper, although of a foundry family, was not connected with the industry. He was president of Huron Machine Co., Chicago.

Harry Hanson, vice-president and secretary of the Griffin Wheel Co., Chicago, died January 12 in Chicago. Mr. Hanson had been with Griffin Wheel for 48 years.

A. F. S. CHAPTER DIRECTORY

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SOUTHERN CALIFORNIA CHAPTER *Secretary*, Harold G. Pagenkopp, Angelus Pattern Works, 2084 Belgrave Ave., Huntington Pk., California.

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TEXAS CHAPTER *Secretary*, John M. Morris, Lone Star Steel Co., P. O. Box 8087, Dallas 5, Texas.

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WESTERN NEW YORK CHAPTER *Secretary*, R. E. Walsh, Hickman, Williams & Co., 32 Eastwood Place, Buffalo, N. Y.

WISCONSIN CHAPTER *Secretary*, J. G. Risney, Risney Foundry Equip. Co., 1307 N. 63rd St., Milwaukee 13.

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OREGON STATE COLLEGE *Secretary*, Leonard M. Preston
TEXAS A & M COLLEGE *Secretary*, R. L. Jones
UNIVERSITY OF ALABAMA

A few of the several hundred foundrymen who attended Central New York Chapter's Christmas Party, December 9.

CHAPTER ACTIVITIES NEWS

Northern California

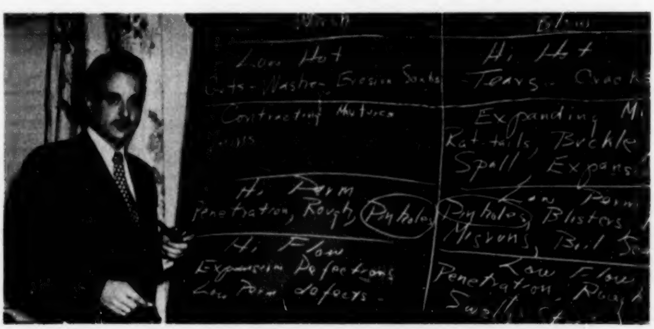
J. M. Snyder
Jos. Musto Sons—Keenan Co.
Publicity Chairman

DECEMBER 8 MEETING, held in the Hotel Shattuck's University Room, Berkeley, featured, *"Practical Aspects of Non-Destructive Testing."*

Organized as a group project, slides were used in the program to illustrate how x-rays or gamma rays and magnetic particle inspection can be used as a foundry inspection tool to insure casting soundness. Presenting the program before 97 members and their guests were: Edwin W. Carter, Vulcan Steel Foundry—*"Magnaflux Inspection and Costs"*; Richard C. Nelson, Pacific Steel Casting Co.—*"Problem Casting in Steel"*; and the following, all from General Metals Corp., Metals Division: William C. Wolff—*"Problem Casting in Gray Iron"*; and Philip McCaffery—*"Theory."* Robert A. Johnson of General Metals Corp. Metals Division, who was to discuss *"Interpretation of Films,"* was unable to carry out his portion of the program because of an attack of laryngitis and his talk was made by other members.

An important phase of the program was the showing of gating and risering methods as first used on castings, and how changes were made after radiographic examination.

In conjunction with the program, "Fathers and Sons Night" honored nine fathers and their "broods", who were accorded a rousing ovation.



A well-filled blackboard attested to a thorough coverage of the subject as Speaker Thomas E. Barlow, Eastern Clay Products, Inc., Jackson, Ohio, outlined principal points of his talk on sand control at Oregon Chapter's November meet. (Photo: Norman Hall, Electric Steel Foundry Co.)

Southern California

S. L. Jacobs
Electro Metallurgical Division,
Union Carbide & Carbon Corp.
Publicity Chairman

ANNUAL STAG CHRISTMAS PARTY was held November 13 at Lakewood Country Club, Long Beach, and was attended by some 400 members and guests.

Members of the Christmas Party Entertainment Committee are to be commended for their excellent work in providing a highly entertaining evening. They are:

Chairman O. J. Stoudt, Brumley-Donaldson Co.; William C. Baud, Food Machinery Co.; James A. Olive, Olive Supply Co.; John Hyatt, Grant & Co.; Morris Gittleman, Pacific Coast Iron Pipe & Fitting Co.; Earl Tibbetts, Los Angeles Steel Casting Co.; Otto N. Ros-

entreter, National Engineering Co.; Ray D. Dorcey, Quality Foundry Co.; John W. Janca, Dayton Foundry Co.; Clinton W. Cook, General Metals Corp.; Dominic Troncale, Aluminum-Brass Foundry; and Charles F. Tingler, Independent Foundry Supply Co.

Central New York
James W. Ogden
Cleveland Tramrail Syracuse Co.
Publicity Chairman

TENTH ANNUAL CHRISTMAS PARTY was held Saturday evening, December 9, at the Hotel Onondaga's Roof Garden, Syracuse. Some 240 members and their guests enjoyed a holiday dinner, followed by a floor show and handing out of more than 90 door prizes by Santa Claus himself.

Committee on arrangements for the party was headed by James Ochsner of Crouse-Hinds Co., assisted by Frank Wheeler, Kinman & Wheeler, Inc.; Robert Wright, United States Graphite Co.; William Dunn, Oberdorfer Foundries, Inc.; John A. Feola, Crouse-Hinds Co.; Nathan Meloon, Jr., Meloon Bronze Foundry, Inc.; Bruce Artz, Pangborn Corp.; Francis Dobbs, New York Air Brake Co.; Jacob Kratz, Crouse-Hinds Co.; and James Ogden, Cleveland Tramrail Syracuse Co.

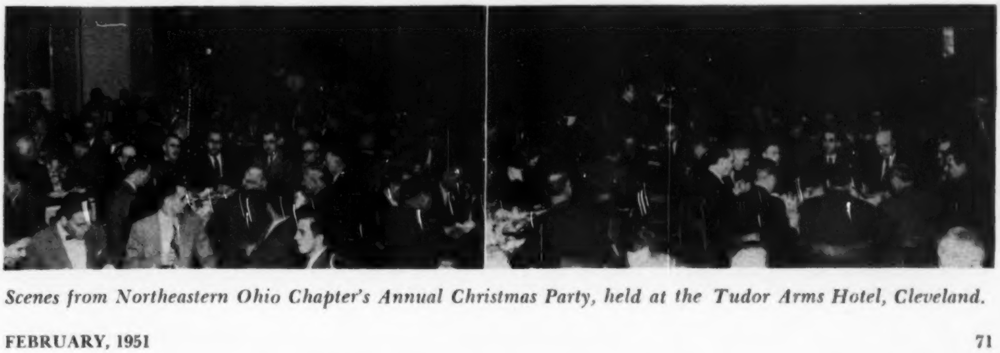
Wisconsin
Donald M. Gerlinger
Walter Gerlinger, Inc.
Publicity Chairman

FOUR ROUND TABLE DISCUSSIONS were featured at the January 12 meeting, held at the Hotel Schroeder, Milwaukee. Running simultaneously were round tables on Gray Iron and Malleable, Steel, Patterns and Non-Ferrous.

Gray Iron and Malleable Iron Group had as co-chairman D. R. Hutchison, Nash-Kelvinator Corp., Kenosha, and Martin Harder, Lakeside Malleable Castings Co., Racine. Speakers on the subject of *"Do Coreblowers Belong in My Shop?"* were L. P. Robinson, Archer-Daniels-Midland Co. (The Werner G. Smith Co. Division),

Vice-Chairman Ralph M. Hill, East St. Louis Castings Co., drew this prize beauty to help him draw prizes at St. Louis District Chapter's annual Christmas Party, held December 14 at the York Hotel, St. Louis.

Committee for Central New York Chapter's Christmas Party, held December 9 at the Onondaga Hotel Roof Garden, Syracuse, were, starting left, bottom row: D. J. Merwin, Oriskany Malleable Iron Co.; Frank C. Wheeler, Kinman & Wheeler, Inc.; Jacob P. Kratz, Crouse-Hinds Co.; Bruce Artz, Pangborn Corp.; James W. Ogden, Cleveland Tramrail Syracuse Co. Left to right, second row: N. W. Meloon, Jr., Meloon Bronze Foundry; Robert H. Wright, United States Graphite Co.; James O. Ochsner, and J. A. Feola, Crouse-Hinds Co.; David Dudgeon, Utica Radiator Corp.



Scenes from Northeastern Ohio Chapter's Annual Christmas Party, held at the Tudor Arms Hotel, Cleveland.

and Lawrence D. Pridmore, International Molding Machine Co., La Grange Park, Ill.

Steel Group meeting was on *"Fundamentals of Steel Foundry Sands,"* with Erwin C. Tetzlaff, Pelton Steel Casting Co., Milwaukee, and George V. Jedinsk, Sivyer Steel Casting Co., Milwaukee, presiding. Speaker was Robert P. Schauss, Illinois Clay Products Co., Chicago.

Pattern Group featured a showing of the sound film *"This is Aluminum,"* with J. R. Patterson, Aluminum Co. of America, Milwaukee, as commentator. Presiding were A. Fischer, Charles Jurack Co., Milwaukee, and T. Arne-

This girl on the flying trapeze was a featured entertainer at St. Louis District Chapter's Annual Christmas Party, held at the York Hotel.

son, Spring City Pattern Works, Waukesha.

Non-Ferrous Group's topic was *"Bearing Bronzes—Make 'Em Right,"* with William Romanoff, H. Kramer & Co., Chicago, speaking. Meeting chairman was J. Kammermeyer, Federated Metals Div., American Smelting & Refining Co., Milwaukee, with Kenneth Jacobs, Standard Brass Works, Milwaukee, as meeting co-chairman.

Mexico City

N. S. Covacevich
La Consolidada, S. A.
Chapter Secretary

In December, upon the occasion of the Mexico City Chapter's anniversary of its founding, members visited the plant of Industria Electrica de Mexico, Mexico City, during the day and in the evening held a dinner commemorating the anniversary.

Officers, directors and members of the Chapter wish to invite any U. S. foundrymen visiting Mexico City to attend meetings of the Chapter. Visiting foundrymen desiring to do so are

FUTURE CHAPTER MEETINGS

● *FEBRUARY 15*
DETROIT
Rackham Memorial, Detroit
Casting Defect Night

● *FEBRUARY 16*
TEXAS
Houston, Texas
Subject to be announced

● *FEBRUARY 19*
QUAD CITY
LeClaire Hotel, Moline, Ill.
E. E. Ballard
Lester B. Knight & Associates, Inc.
"The Modern Foundry—Design, Operation and Maintenance"

● *FEBRUARY 20*
EASTERN NEW YORK
Circle Inn, Lathams, N. Y.
Lyle D. Clark
Buick Motor Div., GMC
"Cupola Operation"

● *FEBRUARY 21*
CENTRAL MICHIGAN
Legion Clubhouse, Battle Creek
R. V. Richter
F. J. McDonald
Central Foundry Div., GMC
"Better Methods Applied to Foundry Operations"

● *FEBRUARY 22-23-24*
BIRMINGHAM DISTRICT
Tutwiler Hotel, Birmingham, Ala.
Birmingham Regional Foundry Conference

● *FEBRUARY 23*
CHESAPEAKE
Engineers Club, Baltimore
Clyde A. Sanders
American Colloid Co.
"Old Time Molder vs. Modern Operator"

TENNESSEE
Hotel Patten, Chattanooga
John M. Kane
American Air Filter Co.
"Present Day Thinking on Control Methods for Dust and Fumes"

● *FEBRUARY 23 (Cont'd)*
ONTARIO
Royal York Hotel, Toronto
A. Evans
"Quality Control"

WASHINGTON
Gowman Hotel, Seattle
Showing of Naval Educational Films on Gating and Risering

● *FEBRUARY 26*
NORTHWESTERN PENNSYLVANIA
Moose Club, Erie
J. E. Rehder
Department of Mines and Technical Surveys, Ottawa, Ont., Canada
Subject to be announced

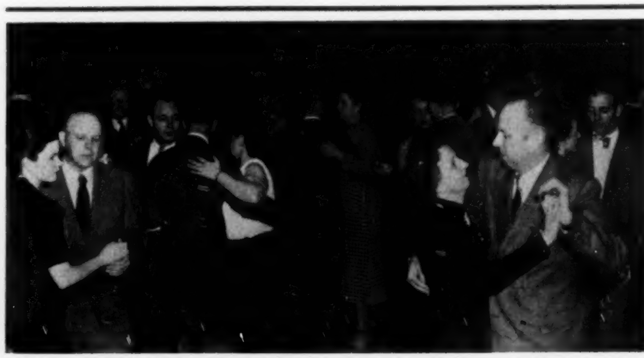
● *MARCH 1*
CANTON DISTRICT
Elks Club, Barberton, Ohio
Sam Keener
Salem Engineering Co.
"My Trip Around the World"
National Officers' Night

● *MARCH 2*
WESTERN NEW YORK
Place, topic and speaker to be announced

● *MARCH 5*
CENTRAL ILLINOIS
Legion Post 2, Peoria, Ill.
Frank S. Brewster
Harry W. Dietert Co.
"Sand Control"

CENTRAL INDIANA
Athenaeum, Indianapolis
Gordon Johnson
Armour Research Foundation
"Sand"

METROPOLITAN
Essex House, Newark, N. J.
Howard Taylor
Massachusetts Institute of Technology
"Bronze Pressure Castings and Their Defects"



Dancing was a highlight of Western Michigan Chapter's annual Christmas Party, held at Spring Lake Country Club, near Muskegon, on December 15.

FUTURE CHAPTER MEETINGS

● ***MARCH 7***
TOLEDO

Toledo Yacht Club, Toledo, Ohio
Topic and speaker to be announced

● ***MARCH 8-9***

Case Institute of Technology, Cleveland

NORTHEASTERN OHIO

CANTON DISTRICT

CINCINNATI DISTRICT

CENTRAL OHIO

OHIO STATE UNIVERSITY

OHIO REGIONAL FOUNDRY CONFERENCE

● ***MARCH 9***
PHILADELPHIA

Franklin Institute, Philadelphia
NON-TECHNICAL MEETING
MICHAEL DORIZAS
"Present World Conditions"

● ***MARCH 12***
MICHIANA

Indiana Club, South Bend, Ind.
PAST CHAIRMEN'S NIGHT

● ***MARCH 13***
TWIN CITY

Covered Wagon, Minneapolis
JOHN STOBIE
Apex Smelting & Refining Co.
"Modern Phases of Aluminum Casting Production"

N. ILLINOIS - S. WISCONSIN

Hotel Faust, Rockford, Ill.
H. E. BALLINGER
Fanner Mfg. Co.
Films: *"Foundry Chaplets"* and *"Chills"*

● ***MARCH 15***
DETROIT

Leland Hotel, Detroit
BRUCE L. SIMPSON
National Engineering Co.
"History and Development of the Foundry Industry"

● ***MARCH 16***
TRI-STATE

Wichita, Kansas
WILLIAM M. BALL, JR.
R. Lavin & Sons, Inc.
"Gates and Risers"

● ***MARCH 16***
TEXAS

Longview, Texas
Plant Visitation to Lone Star Steel Co.

BIRMINGHAM DISTRICT

Tutwiler Hotel, Birmingham
F. S. KLEEMANS
Consulting Engineer, Pittsburgh
"Deoxidation Control of Cast Iron"

● ***MARCH 19***
CINCINNATI DISTRICT

Engineering Society, Cincinnati
SAM F. CARTER
American Cast Iron Pipe Co.
"Basic Lined Cupola"

QUAD CITY

Ft. Armstrong Hotel, Rock Island, Ill.
S. C. MASSARI
A.F.S. Technical Director
Sound-color film: *"Fluid Flow in Transparent Molds—II"*

● ***MARCH 20***
EASTERN NEW YORK

Circle Inn, Lathams, N. Y.
E. C. TROY
Foundry Consultant
"Steel Foundry Practice"

● ***MARCH 21***
CENTRAL MICHIGAN

Legion Clubhouse, Battle Creek
L. P. ROBINSON
O. J. MYERS
Archer-Daniels-Midland Co. (The Werner G. Smith Co. Division)
"Core Binders, Core Sand and Baking Equipment"

Heaping plates were the order of the day at Eastern New York Chapter's Third Annual Stag Christmas Party, held December 19, Circle Inn, Lathams.

requested to communicate with Luis Delgado Vega, manager, Casco S. de R. L., Atenas 32-13, Mexico City, telephone 21-18-78.

Eastern New York

George E. Danner
American Locomotive Works
Publicity Chairman

Third Annual Stag Christmas Party, held December 19 at Circle Inn, Lathams, N. Y., featured an evening of fun, eats and entertainment. As an added surprise, R. N. Williams, Geo. F. Pettinos, Inc., entertainment committee chairman, awarded door prizes.

Chapter Chairman Leo M. Scully,

Speaker at Eastern Canada Chapter's December 8 meeting, held at Montreal, was Philadelphia Chapter's Chairman Clyde B. Jenni, General Steel Castings Corp., who talked on reclamation of foundry sands.

Scully Foundry & Machine Co., thanked the suppliers, who made the party possible, and introduced A.F.S. National Director L. D. Wright, U. S. Radiator Co., Geneva, N. Y., who gave a short talk on A.F.S. membership.

The Chapter sent cards signed by all members to Roy A. Garrison, Adirondack Foundry & Steel, Inc., and Jasper N. Wheeler, Wheeler Bros. Brass Foundries, Inc. who were unable to attend because of illness.

Central New York

James W. Ogden
Cleveland Tramrail Syracuse Co.
Publicity Chairman

JANUARY 12 MEETING, held in the Hotel Onondaga, Syracuse, opened with a short business meeting, during which Chairman David Dudgeon, Jr., Utica Radiator Corp., welcomed some 70 members and guests, introduced new members and visitors from other chapters of A.F.S. Mr. Dudgeon men-

Some of the Mexico City Chapter members who visited Industria Electrica de Mexico, Mexico City, on the occasion of the Chapter's anniversary.

All but five past presidents of Northeastern Ohio Chapter are shown in this photograph, taken at the Chapter's annual Christmas Party. Starting left, first row: Fred J. Pfarr, Lake City Malleable Co., and Walter E. Sicha, Aluminum Co. of America. Second row: Russell F. Lincoln, Russell F. Lincoln & Co.; James G. Goldie, MBM Foundry Co.; William G. Gude, Penton Publishing Co.; F. Ray Fleig, Smith Facing & Supply Co. Third row: Frank G. Steinebach, Penton Publishing Co.; Howard C. Gollmar, Elyria Foundry Div., Industrial Brownhoist Corp.; A.F.S. National President Walton L. Woody, National Malleable & Steel Castings Co., and Jack Tressler, Hickman, Williams & Co., Inc. (Photo courtesy Mr. Pfarr).

tioned that the chapter's pledge to the A.F.S. Building Fund has been paid and thanked those who have contributed toward it.

Evening's speaker was John T. Schenck, Engleberg Huller Co., Syracuse, who spoke on *"Where Do We go From Here?,"* in which he discussed the future of all industry. He pictured today's industrial conditions by saying that as a people we are all "terribly confused."

"I am—I think you are—and there is certainly confusion on the part of our national leaders," he said. "Our boys are dying in Korea and we at home are stalled practically on dead center. In my opinion, we should and must have full-scale wage, price and material controls, which should have been imposed six months ago."

Mr. Schenck concluded by saying, "There can be no 'Gibraltarism' in today's American thinking. We cannot abandon from half to two-thirds of the free people of the world. We cannot escape the responsibility of leadership among the free nations of the world."

Following Mr. Schenck's address, the meeting was divided into three round table sections—Gray Iron, led by Francis Dobbs, New York Air Brake Co., on *"Gray Iron Speaks for Itself"*; Malleable Iron, led by D. J. Merwin, Oriskany Malleable Iron Co., on *"Annealing"*; and Non-Ferrous, led by W. A. Madar, Oberdorfer Foundries, Inc., on *"Metallurgical Aspects of the Defense Program as Applied to Copper and Aluminum Alloys."*

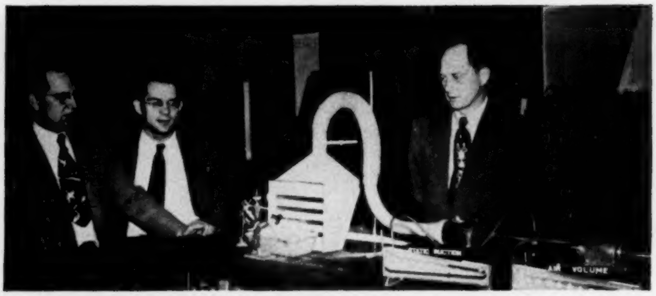
Western Michigan

C. H. Cousineau
Carpenter Bros., Inc.
Publicity Chairman

LADIES NIGHT CHRISTMAS PARTY was held December 15 at Spring Lake Country Club with more than 200 members and their ladies attending. Program featured cocktails from 6 to 6:30 p.m., dinner of fried shrimp or steak, favors for the ladies, a floor show and dancing from 9 to 1.

The party was one of the most en-

These foundry fathers and sons were honored at Northern California Chapter's recent Fathers & Sons Night.



This model of a side exhaust was used to demonstrate a talk on "Principles of Industrial Exhaust Systems," given jointly by (left to right): Kenneth E. Robinson, George E. Tubich and R. S. McClintock of the Division of Industrial Health, Department of Health, State of Michigan. Photograph courtesy of Frank Beetham, Campbell, Wyant & Cannon.

tertaining and successful in the history of the chapter. The party committee is to be congratulated.

December 4 meeting was held at the Cottage Inn, Muskegon, with 129 members attending—a new record.

The program opened with a demonstration by Kenneth E. Robinson, ventilation engineer, R. S. McClintock, district engineer, and George E. Tubich, district engineer, all of the Michigan Department of Health, on *"Principles of Industrial Exhaust Systems."* The demonstration was made effective through use of miniature hoods and blowers.

Second part of the program featured a showing of the A.F.S. Research Film *"Fluid Flow in Transparent Molds—II,"* a remarkable film showing actual flow conditions in molds which was received enthusiastically by the audience.

Third feature was a showing of films on hunting and fishing.

Oregon

J. A. Larkin
Electric Steel Foundry Co.
Chapter Reporter

NOVEMBER MEETING, held in the Georgian Room of the Heathman Hotel, Portland, November 20, featured a talk by Thomas E. Barlow, Eastern Clay Products, Inc., Jackson, Ohio, on "Sand Control."

Mr. Barlow listed the most important measurable physical properties of sand and gave defects that resulted from an extreme in that property.

As outlined by Mr. Barlow, properties and their resulting defects were as follows. Defects are shown below in parenthesis.

Dry sand (cuts, washes); wet sand (rough surface, low permeability defects, high hot strength defects, blow holes); low hot strength (cuts, washes, erosion scabs); high hot strength (tears, cracks); contracting mixtures (veins); expanding mixtures (rat tails, buckles, scabs, fins, spalls); high permeability (penetration, rough surface, pinholes); low permeability (blisters, blows, misruns, boil scabs); high flowability (expansion defects, low permeability defects); low flowability (penetration, rough surface swells).

Some reasons given by Mr. Barlow for improper physical properties are: *Expanding mixture*—lack of a cushion, such as clays, cereals and flours, or improper sand distribution resulting from too many expanding materials such as silica flour and dust; *low permeability*—ramming too hard, too many fines, too many clays; high hot strength—too many clays overmulling, too much water; *low green strength*—insufficient clay or mulling; *low flowability*—too much clay or western bentonite.

Members of the Committee responsible for the success of the Chapter's Annual Christmas Party, held the night of December 15, were:

Chairman E. J. Hyche, Rich Mfg. Co.; Chapter Chairman James T. Brodigan, Columbia Steel Casting Co.; Otis Grant, Electric Steel Foundry Co.; George Bouge, General Tool Co.; George Vann, Northwest Foundry & Furnace Co.; Hugh Templeton, Balfour-Guthrie & Co.; and William Halverson, Electric Steel Foundry Co.

Eastern Canada

A. E. Cartwright
Metallurgist
Crane Co., Ltd.

GUEST SPEAKER at the December 8 meeting, held in the Mount Royal Hotel, Montreal, was Clyde B. Jenni, General Steel Castings Corp., Philadelphia Chapter chairman.

Mr. Jenni's subject was *"Reclama-*

Getting together to prepare material for a joint presentation on "Practical Aspects of Non-Destructive Testing" at Northern California Chapter's December 8 meeting were these co-speakers, shown inspecting a casting at General Metals Corp., before the meeting. Left to right: Richard Nelson, Pacific Steel Casting Co.; William Wolff, Robert Johnston, Phillip McCaffery and Jack Watson, all of General Metals Corp., Metals Division, Oakland, and Edward Carter of the Vulcan Steel Foundry Co., Oakland.

tion of Foundry Sands" and, after a preliminary discussion of the nature and general characteristics of new and used molding and core sands, he proceeded to discuss various means currently in use for partial and complete reclamation of used sands. The least expensive, and that having very limited effect, he said is to remove excess fines with an air stream. This was stated to have little or no effect upon removal of tightly adhering burnt-out binders, either inorganic or organic, from the sand. The wet scrubbing process serves to remove adhering inorganic spent binders such as clay but still is ineffective in removing the greater part of carbonaceous residues left by core oils, cereals and resins, Mr. Jenni said.

The speaker favored a combined process of wet scrubbing followed by a firing process to eliminate both types of impurities. Slide photographs of the appearance of sand grains after wet scrubbing and after combined wet and fired reclamation, showed that the latter method completely restored the original lustrous appearance of quartz grains. The end product was distinguishable from new sand only by a slightly yellower appearance. The fully reclaimed sand is used exactly as is new sand as regards quantity of binders added, the speaker said.

Mr. Jenni, while suggesting that there are many types and combinations of equipment layout suitable for the purpose, showed and described a schematic flow sheet of the process favoured by his company. Most of the equipment included, while not specifically designed for foundry operations, is commercially available as commonly used mine and smelter equipment.

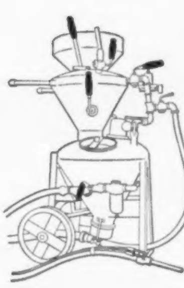
Briefly, the process consists of storing the sand to be reclaimed in a hopper of suitable capacity (in this case 250 tons), from which it enters the first of two wet scrubbers. After a preliminary scrubbing, the 50 per cent sand-water mixture is pumped by a sludge pump into a settling cone and from there enters a second water scrubber. The now wet-cleaned sand goes through a classifier and is hoisted by bucket conveyor to a seven-hearth vertical roasting furnace. As the sand passes down over succeeding hearths through the action of rotating rabble arms, all organic impurities are burnt out by the time the bottom outlet is reached. The furnace is oil-fired, burners being located at the third and fifth hearths. The firing temperature is in the order of 1200 F-1500 F and the sand leaves the furnace at a temperature of about 900 F.

The hot sand is cooled to 250 F or less by passing through a tunnel having

(Continued on Page 84)

NOW- LOTS OF *Cupoline* AVAILABLE FOR IMMEDIATE SHIPMENT!

Our first plant for Cupoline went into production in October, 1949. Very shortly, it was operating 24 hours a day and seven days a week. The plant was enlarged *ten times* in size in June, 1950. It was enlarged another 20% in September, 1950.



Now, a completely new and separate plant is in production and gives us a further 125% expansion in capacity. That means prompt shipments in any quantity.

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Cupoline, as used in the Bondactor Process for cupola patching, means:
(1) speed in patching;
(2) a very substantial reduction in costs;
(3) better cupola control.

EASTERN CLAY PRODUCTS, INC.

JACKSON, OHIO

DIXIE BOND • BLACK HILLS BENTONITE
REVIVO BOND • REVIVO SUPER BOND
BALANCED REVIVO

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BONDING CLAYS and EXCEPTIONAL FOUNDRY SERVICE

Since 1926

BONDACTOR EQUIPMENT • CUPOLINE REFRACTORY • DURA PRODUCTS

NEW . . . Foundry . Products

For additional information on New Products, use postcard at bottom of page.

Industrial Hand Cleaner

1—Lan-O-Kleen, newly-improved industrial powdered hand cleaner, contains high percentage of lanolin and a soap intensifying emollient, lecithin. Manufacturer claims Lan-O-Kleen will remove even the most stubborn industrial soils in warm or cold water and contains no irritating caustics or gritty abrasives. Clog-proof dispenser optional. Samples available. *West Disinfecting Co.*

Plastic Cover Lenses

2—Durlite plastic cover lenses will last up to 125 days under ordinary uses, according to manufacturer, and will fit all helmets and goggles. Features are: complete freedom from pitting, heat resistance up to 300 F, no warping or softening at high temperatures, no discoloration, scratch resistance and optical characteristics comparable to those of plate glass. *American Industrial Safety Equipment Company.*

Safety Tools

3—Safe-T-Kut line of tools, consisting of hand chisels, pneumatic and electric hammer chisels, center punches, backout punches, blacksmith's tools, etc., stress three special safety features: (1) magnetic particle inspection of tools to insure that they will not break off into sharp flying particles, (2) special striking end design of hand tool to diminish tendency of tool to mushroom, and (3) special heat treatment of striking end of hand tools. Warranty is issued with each shipment of Safe-T-Kut tools. *Delaware Tool Steel Corp.*

Under-Car Unloader

4—Combination belt and positive chain drive hopper bottom car unloader handles sand, gravel, or any material loaded on hopper bottom cars. Capacity of unit is 3 tons per minute. *George Haiss Manufacturing Company.*

Electric Cable Hoists

5—Bob Cat heavy duty electric cable hoists, manufactured in ½, 1, 1½, 2, 3 and 5 ton capacities feature total enclosure of motor within cable drum, reducing weight and overall dimensions and completely protecting motors against moisture, splashing liquids, weather, dust and corrosive atmospheres. Hoists are powered by high torque motors and gear reduction is by means of encyclic gear train incorporating load brakes. Load hook oscillates on ball bearings and swivels on roller bearings and is suspended on 5/16 in. preformed plow steel cable. Hook can be replaced without dismantling hoist. Designed for 220, 330, 440 or 550 volt, 3-phase, 60-cycle current, Bob Cats are available with either pendant rope or pushbutton control on pendant cable. *Cleveland Chain Mfg. Co.*

Floor Repair Material

6—Swift-Floor, a plastic floor repair material, patches or resurfaces wood and concrete floors and can easily be installed by unskilled labor by tamping or rolling in a few minutes. Manufacturer claims 50,000-lb load can be trucked over Swift-Floor one minute after application and that the heavier the traffic, the smoother and harder floor becomes. Packed in 55-gal lever-top drums, ready to use without mixing. *Monroe Co., Inc.*

Blast Cleaning Machine

7—Whirl Blaster, made in Hamburg, Germany, and featured at the recent International Trade Fair in Chicago, is a cleaning and dressing machine consisting of a centrifugal wheel used in conjunction with a rotary table. Cleansing action is effected by conversion of blasting material into a smooth fluid emulsion which is blown against material to be cleaned then is carried back to collector and process repeats itself. Features claimed by manufacturer are: automatic suction of gravel through pipe, eliminating need for bucket conveyor; conform radiation of gravel for uniform cleaning of all parts; continuous observation of blasting material; low height (9 ft) on shallow foundation. *Alfred Gutmann Actiengesellschaft.*

(Continued on Page 89)

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FOUNDRY *Literature*

Readers interested in obtaining additional information on items described in Foundry Literature mail postcard below to Reader Service, American Foundryman, 616 S. Michigan Ave., Chicago 5. Refer to items by circling the convenient code numbers.

Rocker Shovels

8—Bulletin L-1022 describes operation and application of EIMCO Rocker Shovels. Illustrations and brief descriptions show applications in a variety of industrial materials handling jobs. Rocker shovels are made of heavy alloy steel castings and run on tracks. Can be used to move waste materials, coke, limestone, sand, etc. *EIMCO Corp.*

Wage and Cost Control

9—8-page booklet outlines a simple, effective system for control of foundry wage payments and costs. This five-part Knight System deals with incentives, labor control, formulas, production control and a simplified standard cost system, revealing reasons behind fluctuations in labor cost per unit of production. Also described are such industrial engineering services as job evaluation, operator training, methods, plant management, materials handling and foundry organization. *Lester B. Knight & Associates, Inc.*

Colorimetric Determination

10—Research paper, *"Direct Colorimetric Determination of Copper and Iron in Tin and Lead Base Alloys,"* discusses use of hydrobromic acid with copper for determining copper in tin and lead base alloys. Further discussed is use of thioglycolic acid as an independent method of determining iron in the same sample. Detailed information is given on reagents and solutions, calibration and preparation of charts, procedures for copper and for iron, and table of results. List of references is included. *Silverstein & Pinsof, Inc.*

Exothermic Ferroalloys

11—Alloys for adding silicon, chromium, or both to gray iron and to steel are described in literature outlining uses of Exothermic Alloys series of ladle additives. Chrom-X briquets can be used for alloying steel or iron, or for chill or grain structure control in gray iron. The Sil-X series, available in both briquet and granular form, provides foundrymen with exothermic materials for alloying, for deoxidation, or for increasing fluidity. For improving the efficiency of risers, Riser-X is available. A 9-page bulletin supplied by the manufacturer describes the history and development of exothermic ferroalloys. *Exothermic Alloy Sales & Services, Inc.*

Battery Specifications

12—Nine new specification sheets designate battery type, capacity, dimensions and weight for fork trucks manufactured by Automatic, Barrett-Cravens, Lyon-Raymond, Market-Forge, Moto-Truc, Revolvator, Stuebing, Towmotor and Yale & Towne. Each battery is illustrated by one to five drawings showing battery layout and layouts and tables indicate type of terminals, plugs or receptacles supplied to fit specific models. Also discussed are new "Z" plates, glass tape insulants and regenerative oxides. *Gould-National Batteries Corp.*

Cranes and Monorails

13—Twenty-page, fully illustrated Bulletin M-20 summarizes reasons where and how Trambeam, a light crane and monorail system handling loads from 250 to 20,000 lb, may be used. *Whiting Corp.*

Foundry Practice Bulletin

14—Vol. No. 100 of Foseco Foundry Practice contains brief articles on *"85-5-5-5 Plug Valve Component Leaking Under Pressure," "Fastening Cores by Nailing," "Treatment of 'T' Alloy (Alcoa Alloy 142),"* and *"Alloy Structures Illustrated and Explained."* Readers of AMERICAN FOUNDRYMAN are invited by the publisher to have their names placed on Foundry Practice's mailing list without charge or obligation. *Foundry Services, Inc.*

(Continued on Page 94)

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CHAPTER ACTIVITIES

(Continued from Page 77)

an ingenious system of water sprays automatically controlled by thermostat. The steam evolved is evacuated through a chimney which also serves to aspirate most fines remaining at that stage. The reclaimed sand is then screened and passed to storage for its next cycle of use.

This system is capable of reclaiming upwards of 100 tons of sand in 24 hour operation at cost, Mr. Jenni estimates, of about 50 per cent of that of laid-down new sand. The process, he pointed out, is most rewarding for steel foundries, but in modified form could be favorably considered by other foundries, presumably those operating with a synthetic sand based on straight silica.

An interesting discussion period was conducted by E. C. Winsborrow, Shawinigan Foundries, Ltd., acting as technical chairman. The speaker answered many pertinent questions, put forward by the audience. W. Turney Shute, Canadian Car and Foundry Co. Ltd. tendered the thanks of the meeting to Mr. Jenni.

Philadelphia

G. H. Bradshaw
Philadelphia Naval Shipyard
Chapter Vice-Chairman

JANUARY 12 MEETING brought out 150 persons to hear Bernard N. Ames, New York Naval Shipyard, Brooklyn, N. Y., speak on *"Plastic Bonded Shell Molds."* Technical Chairman for the evening was G. H. Bradshaw, Philadelphia Naval Shipyard.

The speaker is to be commended for his research on the subject and for his excellent presentation. Slides were used and sample molds exhibited by the speaker, highlighting his talk, which was followed by an interesting question and answer session.

Twin City

J. D. Johnson
Archer-Daniels-Midland Co.
(The Werner G. Smith Co. Division)
Chapter Reporter

EXCELLENT TURNOUT marked the January 9 meeting, held at the Covered Wagon, Minneapolis. Joseph A. Gitzen, Delta Oil Products Co., Milwaukee, spoke on *"Cores and Core Sand Additives."*

Procedure in making cores, Mr. Gitzen said, is not as closely guarded in the foundry industry today as it was years ago. He proceeded to describe material and equipment used in making cores and the reasons for their use. These materials included sand, binders, water and baking ovens.

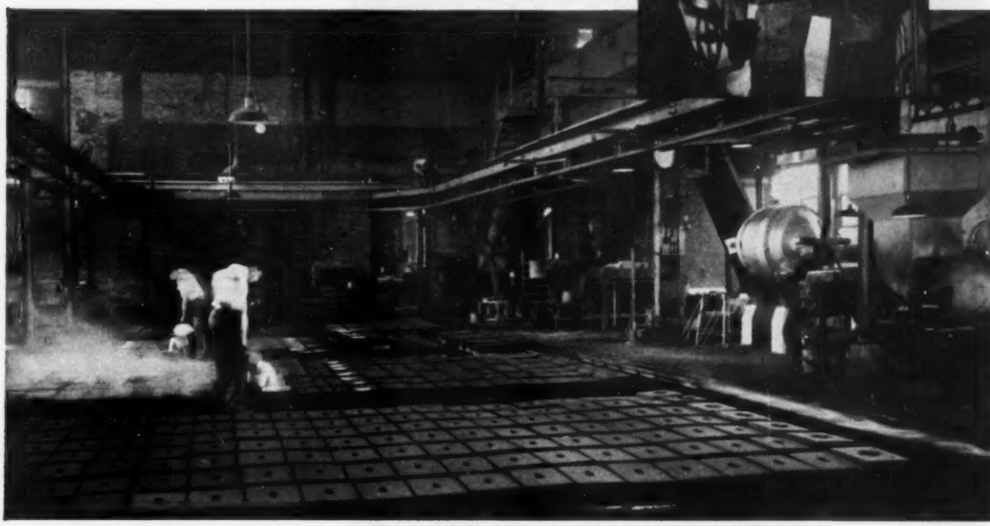
Binders described by the speaker

(Continued on Page 86)

Borings Wanted...

as is

Detroit Rocking Electric Furnace, purchased to remelt borings from concern's own machine shop, proved so fast and efficient that the company buys borings outside to keep furnace working. Borings used as is, not briquetted.



Machine shop to melting furnace to molds . . . an efficient operation using DETROIT ROCKING ELECTRIC FURNACE

Here's another example of improved foundry operation with Detroit Rocking Electric Furnaces.

At Standard Automotive Parts Company, the Detroit, started the same time as the cupola,

Operating graph, Type LFY, 175KW, 700 lb. Detroit Electric Furnace, melting gray iron. Charge, 600 lbs. Total metal, 4200 lbs; total KWH, 1296; av. power consumption, inc. preheat, 617 KWH/ton; total hours operation, 8½; av. melt time, 59 mins.

cold melts until the cupola is ready to tap. They usually have six cold heats, then cold cupola iron is put into the Detroit Electric Furnace, heated, and poured into molds. Furnace used, with excellent efficiency, about 80% unbriquetted borings.

For ferrous and non-ferrous metal melting, Detroit Furnaces are fast, make optimum use of power, produce metal of uniformly high quality, achieve lowest metal loss by shrinkage.

Send your production data. Our engineers will furnish facts on how Detroit Electric Furnaces will fit into your operations.

FEMA

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CHAPTER ACTIVITIES

(Continued from Page 84)

were cereals, pitch, resins, core oils, plastics, clays, silica flours and iron oxides. Properties and reasons for using each were outlined.

In conclusion, Mr. Gitzen stated that poor mulling and baking practices can turn potentially good core sand mixtures into poor ones.

Tennessee

Carl A. Fischer, Jr.
Fischer Supply Co.
Chapter Reporter

October 27 meeting, held in the Hotel Patten, Chattanooga, was attended by some 60 members, who heard Earl E. Woodliff, Detroit foundry sand consultant, speak on *"Molding and Core Sand Control Through Binder Selection."*

Mr. Woodliff said that sand testing as often practiced would be of greater value if less testing was done and more control exercised. He said he did not mean to be critical of sand testing, for it is a definitely needed foundry control, but that the greatest benefits are to be had when men given responsibility analyze the problems at hand and make a concentrated effort to forestall troubles before they materialize. When foresight or preventive maintenance is the watchword, sand control becomes a valued part of the foundry.

Sand control starts with selection and ordering of sand. For new sands purchase specifications must be established based on experience and the desired mold and core properties. The foundry that does not have means of testing incoming cars of new sand should arrange to have an occasional test made by some outside laboratory.

Once the properties of new sands are determined, corrections can be made to obtain satisfactory working properties. New sand must be kept clean in storage, and all supplies kept under cover and in bins which are clearly marked as to type and grade.

The speaker advised selection of sand by clay content, permeability, and grain distribution. Most foundrymen, he added, do not pay enough attention to sand grain distribution, but therein lies the secret of casting finish and control of many common casting defects. Controlling sand grain size secures a smooth casting, a minimum of trouble from buckles, blows, and metal penetration. Mr. Woodliff advocates a greater grain spread for eliminating scabs, blows, and other defects.

The amount of clay desired in natural molding sand will vary depending on work. Too high clay content will often result in clay balls forming. These can be seen at the base of the sand heap after cutting and tempering. This

indicates the clay content is 16 per cent or more—the point at which sand reaches its saturation point.

Mr. Woodliff said Tennessee sands are among the best in the country, but have clay content that tends to burn out rather rapidly, and the sands, due to their high silica content, have high thermal expansion. The results are buckles and rattails. For successful use of most Tennessee sands, some such organic mineral as wood flour or cereal must be used to stabilize them. Seacoal may be used with caution in the place of or in connection with the above.

In purchasing Tennessee sands, it is generally advisable to get 20 to 25 per cent clay content. Use of new sands in the facing will insure freedom from gate scabbing or buckles in most cases. Clay content facing sand alone is a means of overcoming these defects—for clay as it burns shrinks in volume, thus allowing the silica to expand without scabbing or buckling.

Mr. Woodliff said that clay content is determined by two factors in sand control—green strength and type of clay. Clay acts as a bond and a buffer for control of expansion and other defects, he said, and the optimum clay desired ranges from 10 to 12 per cent in facing or molding sand.

Mr. Woodliff said it is worth while to discuss briefly bad and good properties of common binders. Most binders, he said, even though mixed with sand retain individual properties.

He discussed organic, inorganic and patented or blended binders. Organic binders, he said, include wood flour and other cellulose fillers, and promote better collapsibility, reduce sand expansion in rammed molds, and reduce sand buckles and scabbing. Organic binders, according to the speaker, are preferable for casting of gray iron and for some steel facings.

A four-evening Sand School was held under the Chapter's auspices at Kirkman Vocational High School, Chattanooga, November 6 through 9. Some 70 members attended to hear Speaker Frank Brewster of the Harry W. Dietert Co., Detroit.

SFSA Holds Technical Operating Conference

FIFTH ANNUAL Technical and Operating Conference of the Steel Founders' Society of America, held at the Hotel Carter, Cleveland, November 9-11, featured reports on practical applications of research and product development activities.

Some 375 steel foundry executives heard reports on advances in operational efficiency, how to reduce costs and yet improve castings products, disseminating knowledge of the steel foundry industry and its products, and latest technical developments in the field of cast-weld steel construction and welding methods.

FOUNDRY FIRM *Facts*

Sather Manufacturing Co., Inc., is the new name of **Sather Foundry Co.**, Everett, Wash. Ownership, management and policy will remain unchanged.

Norton Co., Worcester, Mass., held a technical conference for editors on January 11 to announce Fused Stabilized Zirconia, a refractory product that in molded shapes will withstand temperatures up to 4600 F. To date this product has been used successfully for furnace lining bricks, heating elements for electric furnaces and for containers and conveyors for molten steel, among others. A poor conductor at low temperatures, Fused Stabilized Zirconia is paradoxically an excellent conductor of electricity at high temperatures. It is a low conductor of heat and has high resistance to thermal shock and to molten metal. The full-day's technical conference program included talks by company research engineers and officials and a tour of Norton's laboratories.

Continuous Metalcast Corp., 17 John St., New York, has been formed to take over American and Canadian rights to the Junghans and Dunross continuous casting patents, as well as those inventions, patents, engineering facilities and licensing agreements owned by Irving Rossi, new company president. Co-owners of the company are Mr. Rossi, **Allegheny Ludlum Steel Corp.**, **Scovill Mfg. Co.**, and the **American Metal Co., Ltd.** First introduced in Germany, the Junghans Process was brought to America by Mr. Rossi and first tested by Scovill in 1938. Since that time Scovill has operated continuous casting machines for brass. Other co-owners of the company, American Metal Co. and Allegheny Ludlum Steel Corp., have continuously cast copper and aluminum and steel with the process.

Lupomatic Industries, Inc., announces that as of January 1, its name has been changed to **Tumb-L-Matic, Inc.** Located at 4510 Bullard Ave., New York 70, the company will continue to manufacture tumbling equipment. It was decided to change the company's name in order to ally its title more closely with its products, officials state.

Whiting Corp. Men's Club held its annual Management Night at the Del Prado Hotel, Chicago, January 11, with 161 members attending. Stevens H. Hammond acted as toastmaster and introduced speakers Brig. Gen. James Mess, president of the Whiting Corp. of Canada, and Allen H. Mogensen, who described the company's new work simplification program. Elected officers of the Men's Club for the coming year are: chairman, R. F. Rice; vice-chairman, Harry Eaton; secretary-treasurer, John Duffy; and directors, Robert Russell, Leo Schmid and Andy Winterbauer.

Presents Volume To A.F.S. Library

Newest acquisition of the A.F.S. Library, a gift of Karl B. Thews, Titanium Alloy Mfg. Div., National Lead Co., New York, is the 320-page volume, *Titanium in Steel*, written by George F. Comstock and Stephen F. Urban of National Lead's Titanium Alloy Div., and Prof. Morris Cohen of Massachusetts Institute of Technology. Illustrated with photographs, charts and graphs, this volume correlates and summarizes available data on use of titanium as an oxidizer, as a carbon and nitrogen stabilizing element, and as an alloying element in steel.

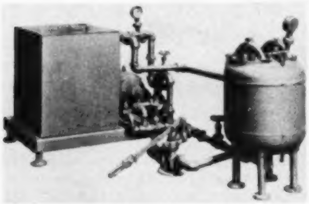
Beginning with brief reference to long existent literature on the subject, the volume goes into detail on the more recent and accurate data compiled from latest experiments in this field.

NEW PRODUCTS

(Continued from Page 81)

Castings Salvage Equipment

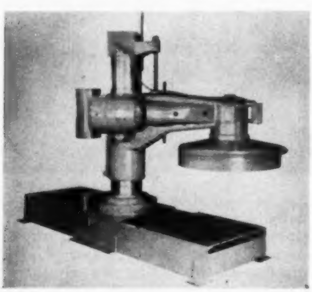
15—Designed to aid small foundries to solve "leaker" problems in small parts and castings, impregnating equipment for sealing pressure castings rejected because of porosity requires no expensive plant alterations or operator skills. Labor and material costs for impregnating castings parts run as low as 3/4 cents per lb. Part or casting once sealed is pressure tight for



life of the part and will withstand any pressure, temperature or chemical condition for which part was originally designed. Both ferrous and non-ferrous metals may be sealed by this process before or after machining and, once part is washed in cold water, bear no evidence of impregnation. Sealant is non-inflammable, non-toxic and non-injurious to the skin. No baking or curing process is required other than 24-hour setting period. *Tincher Products. Co.*

Core Grinder

16—Series No. 71 dual-type core grinders are designed for fast, vibrationless performance in a wide variety of core grinding operations, and make it possible to grind large cores at one grinding station while second station is being unloaded and reloaded. Employing a 42-in. grinding wheel with a 38-in. effective cutting diameter, grinders can handle a wide range of intricate or cumbersome cores. Adjustable wheel arc, balanced to

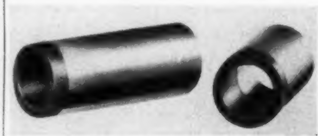


provide smooth performance, swings progressively around complete 360-degree arc to accommodate existing core handling systems at either one of two grinding stations. Wheel height above table ranges from 15-in. minimum to 42-in. maximum. Powered by 5-hp, 900-rpm motor, wheel operates at 242 rpm. Grinder is 91½-in.

high and has 74-in. swing clearance radius. Column, drive shaft and drive shaft are mounted on large dustproof ball bearings to insure vibrationless grinding at all times. *Spo, Inc.*

Sand Arrester Tube

17—Aimed specifically at protection of foundry core boxes, Sand Arrester Tube is guaranteed for more than 100,000 blows and, manufacturer claims, automatically delivers perfect cores with positive elimination of sand stems. Available in any



desired length with outside diameters ranging from 5/16 to 1-1/4 in. in 1/8-in. increments, tubes are easily installed and require no special tools. Steel tube is heavily plated and rustproof. Tip is made of wear resistant rubber that is unaffected by abrasion, oil or water, and is fused to steel tubes by special process. *Martin Engineering Co.*

Rapid Sand Washer

18—No. 512 Rapid Sand Washer, for determining A.F.S. clay content of foundry sands, has been simplified for easier and more economical operation. Washer may be used with graduated beaker or with No. 570 Wash Bottle, with removable bottom. Ordinary wide-mouthed fruit jar

may be used if desired. Vibration-proof gasket separates stirrer from glassware. Syphon tube is adjustable so that correct amount of water may be drawn off with any type of bottle. Unit is easily stored when not in use. *Harry W. Dietert Co.*

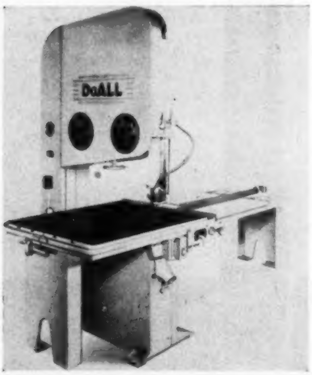
Automatic Emergency Exit Light

19—Light Warden, an instant, automatic emergency exit, assists in safe evacuation of premises should regular source of current fail. Under normal conditions, unit operates in same manner as ordinary exit light. If power source should

fail, however, Light Warden operates instantly and automatically from battery power, also furnishing a powerful down ward beam to illuminate floor area. Unit will furnish approximately 8 hr of emergency light from standard $7\frac{1}{2}$ volt dry battery. *Electric Cord Co.*

Hydraulically-Fed Bandsaw

20—Combining power, speed, range, hydraulic feeding capacity and sawing versatility. HP-36 Hydro-Feed Bandsaw uses standard bands up to 1 in., has 36-in. throat capacity and work height from 15-$\frac{1}{2}$ in. up. Well-guarded, machine features automatic synchronized hydraulic



aircraft brakes, three-speed transmission and overload-protected Speedmaster variable drive that gives tool speed range of 40 to 10,000 fpm. The 40 x 48 in. slotted hydraulic table easily supports work pieces weighing a ton or more. Table stroke is 36 in., with 200 lb pressure available. Infeed rate is controllable up to 18 fpm with quick return. HP-36 will cut thick sections of any ferrous or non-ferrous materials that can be machined with standard carbon steel saw bands and, in addition, will friction saw tough ferrous alloys such as stainless steels up to $\frac{1}{2}$-in. thick several times faster than conventional sawing, manufacturer says. *DoALL Co.*

Adjustable Loading Platform

21—"Make-It-Evener", a device built into a loading platform like a hydraulic elevator, raises or lowers one end of platform while other is held in position by pivot, thus leveling loading platform or dock to height of automobile truck. Also, by installing pivoting platform flush with ground, rear wheels of highway trailers and trucks may be raised or lowered. This type has advantage of eliminating steep ramps. Device can be operated by remote control. *Revolvator Co.*

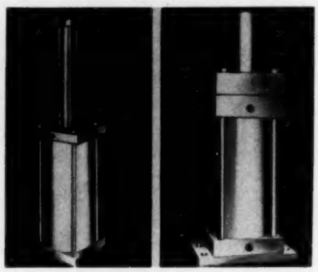
Air Tool

22—Appton Super Hammer is an exceptionally powerful air tool for drilling, chipping, trimming, riveting, sealing, scaling and general applications. Measuring 9 in. overall and with a 1 in. diameter piston, hammer is lightweight and

features no-trigger construction and elimination of recoil kick. Hammer operates when pressed into contact with work, stops when withdrawn. Force of blow is controllable from light tap to full power. Tool operates on pressures from 30 to 100 psi. *Burgess Thomas Co.*

Low-Pressure Air Accumulators

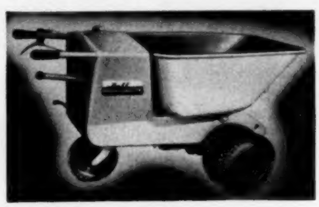
23—Utilizing ordinary plant air at 60 to 200 psi, low-pressure air-operated accumulators eliminate danger of handling high-pressure gases and store fluids at up to 10,000 psi. In pump circuits, oil flows



from pump into accumulator during non-demand pump cycle. Oil, under high pump pressure, works against a hydraulic piston driving larger air piston which in turn works against low-pressure compressible medium. Oil is thus stored at pressures up to 10,000 psi for either immediate or later discharge. Units can be loaded and unloaded at will and can thus be employed in non-pumping applications, or by changing their circuit connections, can be employed as boosters for plant oil or air lines. *Miller Motor Co.*

Powered Wheelbarrow

24—Compactness, maneuverability and rugged construction are features of the new Model 15 powered wheelbarrow, equipped with forward direct drive with



half-speed reverse under power, 5 hp engine, constant mesh transmission and convenient operator controls. Two sizes of platforms with stakes are interchangeable with bucket, all having 1500 lb load capacity. Wheelbarrow is 31-½ in. wide, with 33-in. turning radius and has ample power for steep ramps. *Prime Mover Co.*

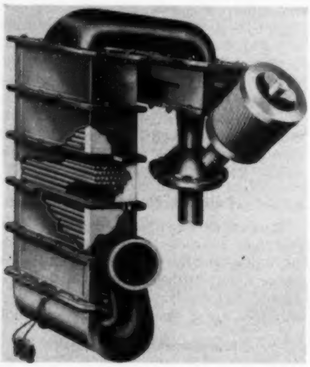
Gas-Fume Respirator

25—Gas-fume respirator protects against mists, dusts, fumes, organic vapors and acid gases occurring in burning, spraying, pouring, welding, cutting and other

industrial operations. Respirator employs twin replaceable filters mounted on wearer's back to remove filters from areas of heavy contaminant concentrations, while permitting unobstructed vision and complete working freedom. Other features are: sure-seal facepiece, guarded exhalation valve and inhalation check valve. Unit weighs 2 lb, 14 oz and is equipped with comfortable all-rubber head and neck bands. *Mine Safety Appliances Co.*

Non-Toxic Lift Truck Exhaust

26—Installed like any standard exhaust, the OCM Exhaust renders exhaust gases non-poisonous and odorless, eliminating a major hazard in gas fork lift truck operations. This is accomplished by



a built-in reacting agent. Easily installed in place of a standard muffler, the OCM Exhaust is guarded by a pyrometer installed on truck's instrument panel. Pyrometer indicates safe-operating range and measures engine's air-fuel ratio, enabling operator to keep constant check on engine efficiency. Unit operates only on unleaded gasoline. Reacting agent is easily replaceable. *Oxy-Catalyst Mfg. Co., Inc.*

Transformer Arc Welders

27—A complete new line of transformer-type arc welders has no moving parts and has eliminated laborious cranking to set welding current. Two models are in production—TSP-205-C with power factor correction rated 200 amperes at 30 volts—and Model TSP-182-C with power factor correction and limited input for operation on REA lines, rated 180 amperes at 25 volts. Control of five main taps of welding current from low to maximum is accomplished with hand wheel switch. Rheostat controls amount of DC current flowing into reactor to give 100 fine welding current settings. *Hobart Bros.*

Non-Electric Magnetic Separator

28—Designed for automatic separation of magnetic and non-magnetic materials, non-electric, permanent Alnico double-drum magnetic separator permits flow of non-magnetic material over drum shell in automatic trajectory but holds magnetics fast to shell surface for separate discharge. Unit is available in nine sizes. *Dings Magnetic Separator Co.*

FOUNDRY LITERATURE

(Continued from Page 82)

Sand Mixers

29—8-page illustrated booklet describes complete line of British sand mixers, giving construction data, mixing principles, clearances, operating instructions, uses with facing sands or heavy loads and applications. *Fordath Engineering Co.*

Acid Pickling

30—Bulletin 584A tells how Wheelabrator Blast cleaning process has influenced cleaning speeds, costs, safety and has eliminated acid disposal in various acid pickling applications, told in case form. *American Wheelabrator & Equipment Corp.*

Car Shakers

31—Bulletin 07B221A describes car shaker for unloading granular material from hopper-bottom gondola cars. Construction features, specifications and a cross-section through vibrating mechanism are given. Bulletin also cites numerous safety features. *Allis-Chalmers Mfg. Co.*

Portable Electric Tools

32—Catalog describes complete line of 360- and 180-cycle portable electric tools, including drills, screwdrivers, grinders, sanders and polishers. Each tool is described and illustrated and complete specifications are given. *Buckeye Tools Corp.*

Metalworking Machines

33—AB-50 Catalog pictures and describes Delta metalworking and woodworking machines and gives detailed information on product specifications, motor recommendations, accessories and prices. Delta Power Tool Div., *Delta Mfg. Co.*

Cut-Off Wheels

34—6-page bulletin No. 6888C lists wheel grade recommendations and cutting performance data, plus operating suggestions for the Delta Cut-Off Machine. *Abrasive Wheel Dept., Manhattan Rubber Div., Raybestos-Manhattan, Inc.*

Air Vibrators

35—Bulletin No. 50, 8 pages, gives overall dimensions, weights, piston diameters, air consumption data and applications for a complete line of air vibrators and accessories. Photographs and line drawings of each unit show bolt hold and air intake locations. *Spo, Inc.*

Aluminum Pattern Equipment

36—16-page illustrated booklet contains complete descriptions of Accurate matchplates, cope and drag plates, pattern castings, dump boxes, booked boxes, and two-impression mated boxes. Purpose of booklet is to show variety of aluminum production pattern equipment that can be pressure cast in plaster, to familiarize readers with pattern material and equipment for the process, and to give a means of estimating costs of pressure castings. Included with the bulletin is a sketch and detail sheet for laying out matchplates. *Accurate Match Plate Co.*

BOOK REVIEWS

Casting and Forming Processes

Casting and Forming Processes in Manufacturing, by James S. Campbell, Jr., assistant professor of Mechanical Engineering, Rensslaer Polytechnic Institute. 536 pp. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 18, N. Y. $5.00. (1950).

Designed as a college level text, this work describes such manufacturing processes as casting, plastics molding and forming, ,powder metallurgy, rolling, forging, sheet-metal working and punch-press work. These process descriptions, while necessarily condensed, are thorough and written in easily-understandable language. Casting and related processes described include molding techniques, materials and equipment, types of molds, methods of making large molds, solidification and risering, gating, sand testing, pattern equipment, cores and coremaking, forces within molds, metals for sand casting, melting, cleaning and finishing, casting defects, centrifugal casting, precision investment, permanent mold casting, and the mechanization, modernization and organization of the foundry.

Plant Engineering

Plant Engineering Handbook, edited by William Staniar. 1955 pp. 1487 illustrations. 544 tables. Published by McGraw-Hill Book Co., 330 West 42nd St., New York 18, N. Y. $15.00. (1950).

Management, operation and maintenance of industrial plants and essentials of good plant engineering practice are dealt with by 86 contributing authors in this compendium. Covered in this volume are: consumption and conservation of basic resources, management engineering, industrial construction; fire protection, maintenance, industrial power and its uses, air handling, materials handling and plant services. Such specialized subjects as instrumentation, bearings and lubrication, engineering materials and mechanical power are among many also presented. Each of the 77 subjects contained in the *Handbook* is an individual treatise on principles observed by the country's leading manufacturing enterprises. Tables, formulae and graphs accompanying each subject provide further reference.

Electric Arc Welding

Electric Arc Welding, Procedure and Practice. 544 pp. Edited and published by Hobart Trade School, Inc., Box EW-146, Troy, Ohio. $2.00.

Profusely illustrated with photographs, charts and diagrams, this comprehensive and practical textbook is of value to the student, welding engineer, operator and designer and for executives interested in welding practice. Written in easily-understandable language, this text is divided into five parts: (1) General Information, (2) Operator Training Course, (3) Carbon Arc Welding and Cutting, (4) Other Welding Processes, and (5) Welding Terms and Their Definitions.

Index to Advertisers

A. F. S. Employment Service

To contact "Help Wanted" or "Position Wanted" advertisers, write to American Foundrymen's Society, 616 S. Michigan Ave., Chicago 5, designating item number and issue of AMERICAN FOUNDRYMAN in which advertisement is published.

HELP WANTED

HW542—Research Metallurgist: Experience in melting and casting of metals desired. Familiarity with ferrous and non-ferrous alloys required. Experience in following important: vacuum melting and casting, melting and casting of titanium, gases dissolved in molten metals, and effect of vibration on solidification. Opportunity to do publishable research in well-equipped laboratory. Minimum education B.S. from well-rated university; doctor's degree desirable. High-grade experience may be substituted for advanced degree. Minimum working experience four years. Civil Service position.

HW557—Core Room Supervisor: Midwestern gray iron foundry desires experienced man capable of supervising production and assembly of small to medium-sized cores. Must be able to teach and coordinate making of cores on benches and coreblowers. In replying, please state age, experience and salary expected.

HW558—Foundry Sales and Service Engineer for Eastern territory. Must have experience in iron and steel foundry sand control, as well as customer contacts.

HW559—Metallurgical Engineer; to take charge of all melting, sand control and laboratory in Midwestern malleable foundry.

HW560—Foundry Supervisor; for Main Bay by one of largest jobbing gray iron shops in Midwest. Castings up to 20 tons.

POSITIONS WANTED

PW154—Plant Manager or Superintendent. Twenty-eight years of gray iron experience. Excellent practical training. Eighteen years in executive capacity. Experienced in production and jobbing, mechanized or non-mechanized. Age 47. Excellent character and references.

PW155—Foundry Engineer: Permanent mold, aluminum and magnesium—25 years experience in all phases estimating, designing, break-in, foundry control, production, and sales engineering. Age 43, available immediately.

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Linoil men are experienced men. They cover every foundry center in the United States and Canada. The average Linoil man brings you twelve years of foundry experience.

Plentiful Production

There are three Linoil manufacturing plants, each with the most modern equipment, and any one of which is capable of supplying the entire foundry industry with core oil.

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